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MODES	FM (F3)	MINIMUM FREQUENCY DEVIATION	±5KHz	SPURIOUS RESPONSE	-60 dB OR BETTER
	*SSB (A3J), CW (A1)	MICROPHONE IMPEDANCE	600 OHMS	SYNTHESIZER	
SUPPLY VOLTAGE	DC 13.8V ±15%	RECEIVER SENSITIVITY	*.4OU, A1 0.5 MICROVOLT INPUT GIVES 10 dB S+N/N 70 0.6 MICROVOLT OR LESS FOR 20 dB QUIETING S+N/N = ON AT 1 MICROVOLT INPUT 20 dB	FREQUENCY RANGE	*144 MHz to 148 MHz
SIZE (mm)	58(H) x 150(W) x 200(D)			STEP SIZE	5 KHz for FM
WEIGHT	2.7				*100 Hz or 5 KHz for SSB
TRANSMITTER				STABILITY	PER C IN THE RANGE OF -10 TO +60C, ±0.0005%/+5%
TX OUTPUT	F3 10W				
	*A3J 10W (PEP), A1 10W				
CARRIER SUPPRESSION	40 dB OR BETTER				

*VALID WITH SSB UNIT ONLY

VHF/UHF AMATEUR AND MARINE COMMUNICATION EQUIPMENT

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EDITORIAL BY WAYNE GREEN

LOST FREQUENCIES

The Jack Anderson column made a big deal out of how many frequencies amateurs have, while carefully skirting a more realistic evaluation of the situation. We're far enough into the space age now so that it should be clear to just about every active ham that while we can always have fun on the low bands, the opportunities of the UHF ham bands via satellites would make possible a communications system far beyond anything imagined in the past.

A series of synchronous satellites would permit several million hams to make contact at any time with any one or group of other hams ... anywhere in the world. This, as the space age came upon us, was the real future that we had ahead. We were beginning to think in terms of getting to work on experimental UHF stations with signals strong enough for satellite work up in the GHz bands.

Then came the 1971 ITU space conference in Geneva ... we were represented there by the ARRL. We went into that conference with about 237,254.77 MHz of amateur allocations for satellite use and we suffered a slight loss. Perhaps you read about it in the fine print in the back of *QST*. The ARRL team came back to announce that we had lost 237,247.27 MHz of satellite frequencies ... with little hope of ever recovering the lost frequencies in the future. That's right — we went into the conference with 237,254.77 MHz and came out with 7.5 MHz.

When you consider that few of the frequencies above 500 MHz hold much promise for us if we can't use them via satellite, perhaps you can appreciate the magnitude of the loss.

There I go being anti-ARRL again ... well, maybe ... but how about you? Is it all okay with you that the ARRL refuses to let anyone else represent amateur radio ... and then screws up the job they've kept anyone else from taking?

What happened at Geneva in 1971? If you go back and blow the dust off your old *QST*, you'll read the story ... our "representatives" went to the conference without preparation. They were completely surprised by what happened and had no plan to meet the situation. They found the delegates from the third world countries anti-amateur radio, largely due to not knowing much about it. This is a natural situation and one about which I've been writing for many years.

If the ARRL had spent even a tiny fraction of the membership funds which they are squandering on plush offices to get out there and meet government officials from smaller countries, we might well have the bright prospects of synchronous satellites and several thousand megahertz to experiment with.

So call me anti-ARRL if you want ... I'm *not* anti-League or pro-League ... I just am telling you what is what. I don't think amateur radio would do any worse if the League were to fold up tomorrow ... as a matter of fact, it might be beneficial because then someone might set up a national club which would be run for the benefit of the amateurs instead of a small group of career "hams" in Newington. I put "hams" in quotes because I have little indication that any of them pay much more than lip service to the hobby.

If you are an ARRL member and you have no objection to a bunch of guys in Connecticut spending your money on lovely offices while pretending to serve you, then you have no gripe. If you don't mind losing 99.99684% of your satellite frequencies at a conference where *you* paid the bills to be protected ... all okay. This is probably a small price to pay for being pro-ARRL.

If you do object to the charade of pretend representation ... of getting along with no lobby in Washington ... with losing your frequencies in huge gobs ... with the damnedest rules being spawned by the ARRL and being passed by the FCC (have you really forgotten "incentive licensing" yet?) ... if these things bother you, then, dammit, speak up and let that bunch of parasites know you want a change. The next time an election of directors comes up, make sure that someone who is more interested in amateur radio than the power and prestige of being an ARRL official is put up for election ... and elected. Within two years you could change the League completely, since half of the directors are elected every year. Within two years you could get in a bunch of fellows who could turn the ARRL into a powerful lobby for amateur radio ... who would make sure that nothing like that Jack Anderson column happened.

As far as saving our bacon at the 1979 WARC conference, it's too late to count on the ARRL. It would take two years to get enough directors elected to turn things around, and the conference will already be upon us. Those third world countries are still anti-amateur radio, and you can bet that when it comes to a choice between frequencies for a bunch of American hams or for their own needs ... or even remotely possible needs ... we are not going to get the vote.

This is purely a matter of public relations. Amateur radio is of immense importance to these countries ... only they don't know it. No one has gone over to visit them and show them what amateur radio can do for them in the way of helping their country to develop ... getting them technicians and engineers for their communications ... spreading the word about their country to the people of other countries. As far as I know, this has happened in just one country ... and I did that. It can be done ... so why isn't the ARRL doing it?

Okay, so it is too late to get any help from the League ... what other possibility is there? Sure, I can get out there and visit a country a year ... which might end us up with two more votes for amateur radio. But I'm already working 100 hour weeks just trying to keep up with what I've got going now. You need some teams out there ... and this takes money ... and the only group with a whole lot of money is the ARRL (and they're spending it all on new plush offices). Well, what about the ham industry? Maybe they can get something hung together in time to do some good. I'll talk to them about it, but in the past the League has been able to discourage such industry groups from getting together ... we'll see.

If the industry can get together and get something started, I think *73* will back them as much as possible. We need to get into contact with third world countries ... we need a lobby in Washington desperately ... one which can contact Congress (the ARRL is forbidden by law from lobbying) ... and can keep in touch with the FCC to help them provide us with the best rules possible.

With the ARRL failing on all counts, I see no other hope than our ham industry.

COWAN PUSHES 220 MHZ CB

CQ's publisher has gone to the newspapers with a CB column distributed by King Features, the main purpose of which seems to be to force the FCC into putting CB on the 220 MHz ham band. A recent column went on to exhaustive length about the joys of using repeaters for autopatch operation ... and then went on to say that CBers could make all these fantastic free phone calls from their cars at a fraction of the mobile telephone rates if they would force the

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FCC to open up the 220 MHz band for CB. Who knows, Cowan may be right ... all it may take is pressure from a few thousand CBers on their congressmen to make the FCC take our ham band and turn it into another citizens band. Congress pulls a lot of weight.

The next time you are thinking of supporting *CQ*, you might just refresh your memory on this one. It wouldn't hurt to bring it up at the next club meeting. Cowan, who publishes the largest of the CB magazines and the smallest of the ham magazines, obviously has his chips bet where the money is ... on CB. *CQ* is small because of neglect ... Cowan tells us this in his own editorials. My understanding is that he is just making time with it until the FCC comes through with the Communicator license, at which time *CQ* will become a Communicator magazine ... in competition with *Ham Horizons*.

LOOKING ON THE BRIGHT SIDE

All these worrywarts who are griping about the ARRL make me sick. Why not look on the happy side of things? Sure, we stand to lose a good part of our low bands at the 1979 WARC meeting in Geneva, but the loss certainly isn't going to be as catastrophic as the 1971 debacle when we lost virtually all of our satellite frequencies ... under ARRL representation. In case you've forgotten, the ARRL went into the conference with 237,254.77 MHz in satellite ham frequencies and came out with 7.5 MHz, a loss of 237,247.27 MHz ... 99.99684% lost.

In most fields a group that provided that quality of representation would be replaced, but not in amateur radio ... the ARRL still has the 100% enthusiastic support of most amateurs despite its total impotence. That's real loyalty and should be applauded.

As I say, it doesn't seem possible that we can get quite the screwing on our low bands that we did on the VHF bands, though there is no one who understands the situation who is in any way optimistic. It does appear that we will lose large parts of the low bands, since even the United States appears to be ganging up against the League on this.

When we lose parts of our bands, we will merely have to economize. Any study of the usage of our bands will clearly show that we can substantially increase our efficiency of operation. Take those pileups of stations trying to make rare DX contacts ... the actual contact takes perhaps 15 seconds ... the calling and interference drags it out for hours for hundreds or even thousands of operators. All that has to be communicated is the call letters and signal strength, something which could be compressed into less than a second with a good fast RTTY system ... perhaps with the help of a computer. DXpeditions could work thousands of stations per hour and still generate virtually no QRM.

How about nets? If you listen much above 14,275 you hear hundreds of nets, many spending hours trying to finish their lengthy call-in procedures. This is another natural for modern techniques ... some fast RTTY with a microcomputer and the net of five hundred stations could be checked in ... in a few minutes.

This is getting exciting ... how about two meter repeater operating? About 17% of the air time on a repeater is used in repetitive identifying ... a natural for new techniques. Will the 1978 two meter rig have an LED readout to show the call of the chap you are contacting? No reason why not. A quick blip will give the call and handle at the beginning of each transmission.

Perhaps we can go further with this ... since 23% of repeater time is spent by fellows calling someone else who is not there to answer, this could be automated ... and reduced to almost nothing. Calling CQ on the repeater ... yes, I know we don't call CQ, but we do call CQ, only in other words ... could be sped up, too. We're getting places now ... another 8% of the contacts are involved with a description of where the mobile operator is driving at the time ... perhaps we could agree to delete this relatively unimportant data. 11% of the air time is spent describing the gear being used ... and since this comes down to perhaps a dozen different rigs, we could encode that with one single character. Perhaps you see where I'm headed ... with over 99% of the average ham contact strictly routine, why not achieve some real efficiency by setting up an accepted group of abbreviations? This could cut QSOs down to a second or two each and permit far more hams to use what few channels we have left after 1979.

If this doesn't get your vote, then I have an alternate plan. Since the ARRL has done about the worst possible job of representing us that it was possible to do, perhaps we should look around for some other group to step in and do a better one. I think I have a suggestion along this line ... one that will surprise you. The ARRL isn't the only group out there pushing for frequencies ... there are many other groups ... such as the EIA ... but these others are not ham groups, so we might get stabbed in the back if we depended on them ... even so, it might not be worse than we've been getting. Never mind, the one group of hams that has been getting a lot of play recently are those great chaps down at *CQ Magazine*. Dick Cowan WA2LRO is making real progress in his push to get the ham 220 MHz band turned into a CB band ... he seems to be doing a lot better at it than the ARRL is in trying to stop him. And George Jacobs W3ASK appears to be working with incredible success to get choice ham bands for his beloved Voice of America ... George is the *CQ Magazine* propagation editor.

I realize that this is heretical, but how about turning to *CQ Magazine* as our representatives instead of *QST* ... since *CQ* seems to be doing far better at what they are doing than *QST*? We have nothing much more to lose.

DRAFTING HELP NEEDED

We're looking for someone to move up here and work at drafting diagrams for *73*, *Kilobaud*, and our books. Most of this work is farmed out right now, which means delays. If you enjoy this sort of work and are good at it, drop me a line.

THE MICROCOMPUTERISTS

Of the somewhat over 10,000 hobby computerists who have their own computer systems up and running, about 2,500 are licensed amateurs. And, judging from the interest in computers shown at hamfests and conventions, the percentage of computerists who are also hams is going to hang right in there.

There are a growing number of hamfests which are combined with computerfests ... a combination which is the best of both worlds because most hams are interested in computers these days ... and vice versa.

Considering the number of amateurs who have been playing around with microcomputers, the number of good articles submitted to *73* has been quite low. I'm most anxious to get all of the information I can on how to interface these gadgets with our ham stations ... I'd like to see articles on I/O devices ... on uses around the ham shack ... on problems you've run into and how you solved them ... on experiments with high speed computer generated and computer decoded Morse Code ... on any experiments with ASCII ... on any of the new hardware being brought out which is particularly useful for hams ... etc.

Despite enthusiastic articles about the microcomputer industry in most of the professional computer magazines and in papers such as the *Wall Street Journal*, the fact is that this is still a very small and fragile business. Most of the firms in the field are much smaller than you might imagine and the sudden appearance of any major firm could be disastrous. There is an interesting and perhaps destructive dichotomy involved ... these small firms have a psychological need to be accepted by their larger and older brothers who make the mini and maxi computers, and so the small firms are forever trying to get promotion which will call attention to themselves in the field ... yet if they succeed in getting the attention, any one of a hundred larger firms could easily put many, if not most, of the micro firms out of business.

The manufacturers and dealers in the hobby computer industry are getting together to form an industry group, and this might give them enough strength to weather an invasion by one of the behemoths. It would be nice to keep this as a field in which a small entrepreneur could put his idea into production and do well for himself ... and that is where it is at right now.

Actually there are a great many ways to turn the computer hobby to a profit and a hobbyist has to be either remarkably lazy or not in need of funds to miss out. Some are doing quite well by keeping track of their adventures with getting their systems to work and writing for the many computer hobby magazines ... there are about nine or so which publish this sort of thing ... make that ten, counting *73*. Other hobbyists are either working for computer stores or opening them ... and they are on the whole faring well. Some are writing programs for profit ... some doing consulting work ... some inventing hardware and selling it to manufacturers ... some are getting into manufacturing.

What about all those magazines? They run the gamut, from *Personal Computing*, which is beautifully done and aimed at the pre-hobbyist, with articles telling of the things you can do with hobby computers, but low on construction projects ... to *Creative Computing*, which is a sort of fantasyland combination of school computing and science fiction ... *PCC*, People's Computing Company, a newspaper type of publication aimed at school use, particularly by youngsters ... *Kilobaud*, aimed at the newcomer to hobby computing, with articles on hardware, software, and systems. *Kilobaud* is packed full of material of interest to hobbyists. *Interface Age* is a fat magazine loaded with new product releases and a few articles aimed more at the OEM market and not too much for the hobbyist. *Byte* is going higher and higher level, aiming at the scientist and advanced computer engineer, and is a bewilderment to the newcomer.

COMPUTERMANIA

Over 12,000 computer hobbyists turned out for the recent San Francisco Computer Fair ... making about 200 exhibitors very happy. The Civic Center was so crowded that you could barely walk around ... and no wonder, for the exhibitors were showing some absolutely astounding devices and systems.

Along the ham line was the new ham board from the Digital Group ... one board with RTTY, SSTV and Morse code on it.

The next big computerfest will be at Atlanta on June 18-19 ... part of the Atlanta Hamfestival. If you are within driving distance of Atlanta don't miss this one.

In July (30-31) the action will be at Seattle, the first big computerfest in the Northwest ... not to be missed.

In August we'll be running Computermania ... the biggest exposition yet of microcomputers. This show will go all the way from advanced calculators, through video games and microcomputers, right on up into small business computer systems. This will be at the Commonwealth Pier in Boston on August 25-26-27th ... Thursday, Friday, and Saturday. The show will be run by *73* and its staff.

We're expecting over 300 exhibitors and 25,000 or more attendees. It will be the biggest and best show yet in the whole field of small computers. If you are interested in looking at what is available in microcomputers and shopping around, this will be the place to go.

Make your plans accordingly.

RTTY Loop

Most active hams have operated on the low bands, chased a bit of DX when it's around, and joined in on the fun on 2m FM. Some have even tried 220 and 432, with a hearty few tackling 1296 and EME. However, if you are like most of the amateurs I know, the day-to-day "routine" of hamming needs an occasional change of pace. Two meters can get old pretty fast when the local repeater group is stagnant, and even the dedicated rag chewer tires of fighting the QRM on 40 every evening.

If you are sick of cranking up on .52 every night, and 75 has you down, possibly a new mode will liven up the time you have allocated for hamming. Let's look at the possibilities: Let's see, there are those OSCAR satellites up there, and SSTV, and what about FAX, TV, microwaves, or RTTY? And, how about those microcomputers, which can be tied into almost every facet of ham radio? There is no excuse for anyone being bored with ham radio, and if one facet of communication is getting old, there is always something new to try. For openers, consider RTTY! Here is a mode that offers just about everything. It does not cost a fortune to get on RTTY; it will be seen that a complete RTTY station can be assembled for under $100! The required printers and keyboard are commonly available, and the electronics can be assembled from readily obtained parts. A radioteletype station can be used on most of our bands, and interfaced to existing station equipment. RTTY also lends itself to state-of-the-art techniques — many hams, myself included, have interfaced computers to existing RTTY equipment, and it shouldn't be long before "quiet" RTTY stations based upon surplus video displays are commonplace.

Interesting things can happen when a group of hams stumble on a new mode. Last summer, a friend with a RTTY station got me interested, and within a matter of days I was on 20m and 2m with a $25 keyboard-printer and inexpensive terminal unit. Well, one thing led to another, and by Christmas a highly active net had formed on a 2m splinter channel. It didn't take long for others to find out what those weird tones were, and soon never-before-heard 2m stations were calling in on RTTY, as it is possible to monitor a frequency all day with equipment that is silent except when a message is transmitted. This "autostart" operation is only one of the special features offered by RTTY. If you're interested, read on!

In response to considerable demand from our readers, *73* is going to provide a monthly RTTY column, the *RTTY Loop*, aimed at present and potential enthusiasts. The idea for a continuing RTTY series has been lurking around for some time, but it took a combination of things to get it going. Several days ago, I received a letter from Marc Leavey WA3AJR, who has written for *73* in the past, and is presently writing a RTTY series for the Baltimore Amateur Radio Club's journal, the *Modulator*. One thing led to another, and the *RTTY Loop* was formed. Marc will provide information for the ham interested in getting started on RTTY in an easy-to-understand fashion. In following months, advanced techniques will be discussed, such as autostart, selective calling, digital control, video displays, and, of course, computer-controlled RTTY. The possibilities are limitless! Your response to this new effort is solicited. Please address any comments, questions, suggestions, and criticisms to "RTTY," *73 Magazine*, Peterborough NH 03458. I will forward all material to Marc, who is responsible for the content of the column. Let's get started, and I hope you like the column!

John Molnar WA3ETD
Executive Editor

TELE-TIPS 1

This month, and for a couple following months, we will be discussing the principles of RTTY operation. As with any new field, there are a multitude of terms and definitions that must be understood before getting involved in details. Naturally, new terms will be popping up in the months to come, and they will be dealt with when they arise. Be patient — things will fall into place! Presented below is a brief glossary of common Teletype terms. Many of these are familar, and will serve to refresh the RTTY pro. It might be a good idea to save this list, and add to it as the months pass. Each month will have a glossary of new terms, so it will be possible to maintain a complete list. Let's get started, then, with some common definitions:

AFSK: Stands for Audio Frequency Shift Keying and is a means of encoding the Teletype information by changing the frequency of an audio tone.

CHAD: When you punch a hole in a piece of paper, the plug that comes out is called a chad. Paper tape, punched with many holes to serve as a memory, generates tons of these chads.

CHADLESS: Obviously, without chads. If you want to type on the tape with the holes in it, the absence of paper where the holes are makes it difficult. Chadless tape leaves the plugs attached by little lips, to permit it.

DEMOD: Short for Demodulator, this is the electronic marvel that converts the warbling tones of rf into pulsed dc that the Teletype machine can interpret.

FOX TAPE (or KEY): There is a marvelous sentence that contains all the letters of the alphabet — THE QUICK BROWN FOX JUMPS OVER THE LAZY YELLOW DOG. One frequently has a tape to send this for test purposes. Some of the new digital Teletype setups have this sentence preprogrammed at the touch of a key.

FSK: Stands for Frequency Shift Keying. Similar to AFSK, the frequency of a radio carrier is shifted to encode the TTY information.

GOVERNOR: Not the man in your state capitol. Teletype machines are run by motors, and it is important for the motor to be turning at a precise speed. Older machines, or those intended for ac/dc work, used a governor on the motor to set the speed. A special tuning fork is used to set the motor.

LOCAL LOOP: If you hook all your equipment together so that anything you type on the keyboard prints on the printer, kind of like a big electric typewriter, that's a local loop. Essential for testing.

MARK: Spelled differently than my first name, this is the state when everything is running quietly, and loop current is present. Could call it "1" if you're into logic.

MODEL 12, 14, 15, 28, 32: These are different series and styles of Teletype machines. The Model 15 is the "standard," and consists of a keyboard and page printer on a table. The Model 19 is a Model 15 with tape equipment built in. The tape equipment alone might be a Model 12 or 14. The Model 28 or 32 is more recent vintage stuff.

PAGE PRINTER: If the Teletype machine prints on a roll of paper which, when you tear it off, looks like a page, that's a page printer.

PATCH PANEL: One of those can't-do-without things. Usually a jack strip which allows anything to be connected to anything (*anything?*).

PERFORATOR: A keyboard connected to an electromagnetic device which punches tape as you type is a perforator. This cannot punch tape from an incoming signal.

POLAR RELAY: Normal, spring return relays take more energy to make than to hold. This would cause distortion in the Teletype signal, called bias, which will be covered later. A polar relay uses two magnets, one to make and one to break, to overcome this problem. A bias (no relation) supply is needed for one of those windings.

RATT: This is the MARS abbreviation for radioteletype. Don't ask me why.

REPERFORATOR: A tape punch which decodes incoming signals and punches them into tape is a reperforator. Some versions type on the tape at the same time, and are called Typing Reperfs, of course, and are chadless!

RTTY: The ham's abbreviation for radioteletype.

RY: These two letters contain all bits in the Teletype code. Don't worry about it — we will discuss it later — but it makes a fine test signal (RYRYRYRYRY).

SPACE: See also MARK. This is the state without loop strip of paper and reminds one of the stock market ticker; it's a strip printer.

SYNCH MOTOR: Since the motor for a Teletype machine has to be a precise speed, it is nice to synchronize it to the 60 Hz line frequency. Takes the place of governor motor.

TD: Stands for Transmitting-Distributor (which is quite a mouthful). Actually, this is a tape reader.

TT, TTY: More abbreviations for Teletype.

TELETYPE: The whole ball of wax we are talking about. This is a trademark, however, and should always be capitalized.

TU: Stands for Terminal Unit, and is the same thing as a Demodulator.

That has got to be enough to digest for this month! Next time we will cover just how that Teletype machine works.

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Model 15 page printer.

LETTERS

CLOSE TO HOME

Dear Jack Anderson,

I've been a fan of yours for years, but one of your recent columns, the one on CB vs. ham radio, struck close to home. The one-sided nature of the column was unfortunate.

Radio amateurs (hams) must pass an examination, which includes knowledge of the international Morse code. By international agreement there is to be *no* hobby use of the spectrum below 144 MHz unless the operator has demonstrated this knowledge of Morse code. Technically, the recent FCC rule change to allow hobby use of CB at 27 MHz is in violation of that agreement.

I believe most CBers are potential hams frustrated by the code requirements. The FCC has proposed a code-free license for frequencies above 144 MHz, but has been unable to implement it due to the crush of CB license applications. It would seem more constructive to support the implementation of this proposal, rather than to encourage the expansion of CB chaos at the expense of hams.

Phillip Nelson WA6PNA
Albany CA

POLITICAL FOOTBALL

I truly believe amateur radio is about to face its toughest hour, which will decide if our hobby will continue as we know it or slowly "pass away." Amateur radio is definitely becoming political football in Washington DC. More and more, it seems that the sides are being drawn up between amateur radio and CB, or David and Goliath. If we are not properly prepared for this fight, we will lose our only national resource forever, i.e., the ham frequencies.

The enclosed Jack Anderson article is filled with half-truths, insinuations, misleading statements, etc., which to the average reader portray hams in a very unfavorable light. Note the quotes from Anderson's article — "The FCC is quietly stifling the millions of voices that jam the CB radio frequencies . . . The Commission has favored the few (hams) over the many (CBers) . . . 300,000 hams have 100 times more frequency allocations than are available to CB . . . ARRL is a lobbying organization" . . . and on and on. But, there is no mention of the purpose of amateur radio, its contributions to public service, national welfare, communications developments, history, service in emergencies, and so on.

I would consider this article to be extremely damaging to amateur radio. Can you imagine the impact this article will have on the US Congress? Please do whatever is required to answer this extremely biased article.

Glenn Packard K3ZOT
Havertown PA

CAHOOTS

Mr. Jack Anderson
c/o *Washington Post*
Washington DC

You had some rather harsh things to say about amateur radio operators in your *Washington Post* column of April 4, 1977. Most of what you said was false. Most of what you insinuated was false. You insulted every amateur radio operator in the United States.

You implied that myself and my fellow hams are in cahoots with the Federal Communications Commission and are in some way depriving the Citizens Radio Service operators of frequency spectrum space that rightfully should belong to them.

Your first mistake was to equate the Citizens Radio Service and the Amateur Radio Service. Both services use radio and there the resemblance ends.

The purpose of this letter is to provide to you some basic information regarding both radio services so that when next you write about ham radio, you will have some facts for reference. I speak for no one but myself . . . and I feel sure, thousands of ham operators. I thank you in advance for your time and attention to what I have to say.

First, examine how the respective radio service licenses are obtained. The amateur radio operator took a series of tests administered by FCC engineers that covered radio theory and practice, rules and regulations of U.S. as well as international amateur radio, and demonstrated proficiency in sending and receiving international Morse code. Failing to pass any one test results in no license.

The Citizens Band operator filled out a simple form about as complex as applying for a social security card. That's all. In fact, under today's rules, the Citizens Band operator gets a temporary license when he buys his equipment. He has that to use while he waits for the FCC office to issue his permanent license.

Look at both licenses. What really do they cover?

Amateur radio operators hold an equipment license that covers the station itself. He also holds an operator's license. The ham is personally identified. Only he can operate his radio equipment. Other people can talk over it but his hands must be on the controls at all times. There are exceptions to those rules, but they involve other licensed amateurs.

The Citizens Band operator does not hold an operator's license. Only the radio equipment is licensed — not the operator. Because there is no operator's license involved, any relative of the person named on the license can operate the station (over age 18 only). The Citizens Band operator is not personally identified.

What is the charter of the two radio services? That is, what is expected of them? Both are utilizing a public property, a resource, the electromagnetic spectrum. It is not infinite. With regard to the Amateur Radio Service, the Communications Act of 1934 put heavy emphasis on ". . . value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications." That language is still in place and is taken very seriously by hams worldwide. Many hams maintain emergency power sources for their stations so that no matter when an emergency call goes out, responses to the call can be made. Citizens Radio Service operators also provide communications for the public good and that is commendable, but the hams have been honing their communications skills since 1913. The hams have the organization, the expertise, the network of stations and, most important of all, the strict radio discipline that results in efficient operation no matter what the situation.

The list of instances of ham radio as the principal and many times the only means of communications is almost endless. Some of the most recent were the earthquake in Alaska in 1964, Peru in 1970, California in 1971, Guatemala in 1976, Italy in 1976, the Dakota floods and the Big Thompson Canyon, Colorado Hurricane Agnes in 1972, and recently and locally, the Frederick flood in October, 1976.

The charter of the ham operator includes contribution to the advancement of the radio art and electronic advancement, self-training and technical investigation solely with a personal aim and without pecuniary interest of any kind.

The mission of the Citizens Radio Service? To provide private short distance radio communications services for business and personal activities of the licensees. There's quite a difference isn't there?

To address some of your comments in the *Washington Post:*

How can the FCC be stifling the Citizens Radio Service when it just granted 17 additional channels on Jan. 1, 1977?

Why do you say that the Amateur Radio Service should give up spectrum space to the Citizens Radio Service? We gave up the space they now occupy.

The hams don't have a lock on the higher frequencies. Quite the opposite. And those frequencies are *not* interference free.

The hams do not control any frequencies. Only the FCC can make frequency assignments and that task has got to be one of the most difficult and thankless chores in the world to do. It's a no-win situation every time.

The ARRL has put out no "flash bulletin," and it is illegal for *anyone* to transmit on an unauthorized frequency, be it ham, CBer, or ordinary businessman.

This letter is being released to the news media, governmental officials, and the American Radio Relay League.

David R. Halliburton WA3ZOR
Gaithersburg MD

"AIRSPACE"

Editor
The *Washington Post*
Washington DC

The article by Mr. Anderson strongly implies wrongdoing by the Federal Communications Commission (FCC) in its regulation of the Citizens Radio Service ("CB") for the benefit of the Amateur Radio Service ("hams"). Although basic information in Mr. Anderson's article is factually true, it is distorted and incomplete. It reveals both a lack of knowledge on the subject of radio communications and a lack of professional reporting in the art of journalism.

The major issue made in the article is that hams have more frequency spectrum ("more airspace") than the vast majority of CB users, public service user (police and fire departments), FM radio broadcasters, and TV stations in Los Angeles and New York City. This is a true statement. But Mr. Anderson apparently does not understand that radio frequencies differ in characteristics.

At very high frequencies (VHF) and ultra high frequencies (UHF), radio communications are extremely reliable and almost interference-free — necessary traits for police and fire units. But, these frequencies are extremely short ranged. Therefore, it is quite feasible for a small frequency spectrum to be used repeatedly throughout an area as large as the United States. Because of the short range characteristics of these signals, Washington Metro Police cars will not be erroneously receiving instructions from Los Angeles police dispatchers.

Citizens Radio Service (CB) has — and still is — intended to be a short range service also. The low power (4 Watts) was to limit range of these radio sets to just a few miles. But when the service was established in 1958, the FCC took frequencies away from the Amateur Radio Service in the high frequency (HF) band. This range of frequencies — and especially in the spectrum which includes CB frequencies — is especially conducive to long range radio communications. Combined with high powered amplifiers (illegal but widely used on CB frequencies) and directional antennas, radio conversations can literally be "skipped" over thousands of miles.

This is why legal CB operators like myself have so much difficulty trying to talk to someone else just a mile away.

Without illegal use of CB privileges, the service would have almost enough radio frequency spectrum for the near future. In most areas of the US (outside of metropolitan areas), little activity occurs on more than a half dozen channels. The FCC has been experimenting with establishing new CB frequencies in the 900 MHz range which would improve reliability of local communications and prevent long distance communications. Most amateurs would be in favor of this move.

The Amateur Radio Service was established to promote the art of radio communications through experimentation, the development of trained personnel, and to promote international goodwill through radio. All of these goals require access to frequencies throughout the radio spectrum.

Since radio began (Marconi claimed himself to be an amateur), hams have been at the forefront of new developments. Much of the present "state of the art" of radio and television communications is either directly or indirectly the result of amateur radio. Most of the electrical engineers and researchers in the area for the past fifty years became interested in radio as youngsters through amateur radio activities. One of the most significant breakthroughs for reliable long distance voice communications – single sideband – used by the military, civil airlines and ships, and by CBers, was entirely developed by amateur operators.

Also since the beginning of radio, hams have been quick to step in and offer communications assistance during times of disasters. The only communication with the outside world for weeks following the terrible Guatemalan earthquake was by amateur radio. The American Radio Relay League (ARRL) even contributed a VHF radio system for local communications inside Guatemala. The Guatemalan government and the Red Cross have recognized that relief efforts there would have been almost impossible without the reliable communications of hams in the US. Similar examples can be given for any number of disasters here in the US and abroad.

Since the radio frequency spectrum became "managed" in the 1920s, frequency allocations for amateurs have shrunk. Yet the number of hams in the US and worldwide has increased. Not only the CB radio industry (which stands to profit even more by more frequencies being assigned to CBers who would have to buy new radios), but many other radio services covet the frequencies now held by the Amateur Radio Service. It appears to users of those services that there is no opposition to taking frequencies away from hams. Contrary to Mr. Anderson's implication, the ARRL is prevented by law from lobbying. Many amateurs and members of the ARRL, in fact, feel the ARRL is not doing enough to protect the interests of hams. Arrayed against the unprotected hams are the airlines, the boating industry, the broadcasters, and the CB manufacturers. Mr. Anderson acknowledges this when he wrote about "... giving the CB *industry* a greater share of the airwaves" (emphasis added). The airwaves belong to the people, not to any industry.

Amateur radio should be viewed as a national resource and protected. Not just because it is a hobby, but because of its continuing contribution to public service and to the development of higher levels of electronics state of the art. It is open to all – even CBers like myself. The only requirement is a desire to learn a little about radio and pass a code test. And if I can do it, anyone can!

Arthur G. Nevins WA4NTP/KGO2773
Sterling Park VA

SENSATIONALISM

Mr. Jack Anderson
c/o *The News American*
Baltimore MD

In your syndicated column of April 4th, a 1977, entitled "Hams Hog The Airwaves," your story seems bent more on sensationalism than in presenting a true picture of amateur radio (ham) or Citizens Band (CB).

You contend that the Federal Communications Commission is quietly stifling the millions of voices that jam the Citizens Band radio frequencies. You further contend that 300,000 hams have 100 times more airspace than is available to the nine million CB enthusiasts and that the hams also have a lock on the higher frequencies, which are free from interference. Let us examine, in depth, your allegations.

First, while it is true that the 300,000 hams of the United States do have more airspace or frequencies than are allocated to the Citizens Band radio enthusiasts, the basic purposes and licensing requirements of the two services are vastly different. It must be remembered that amateur radio is an international service covered under agreements of frequency allocation by the International Telecommunications Union, of which the United States is a member. The Citizens Radio Service is not international and therefore not provided for by the ITU. All that is required of an individual to be licensed in the Citizens Radio Service is merely filling out a form and mailing it to the Federal Communications Commission. On the other hand, for a person to become a licensed amateur radio operator (ham), he or she must first demonstrate to a duly authorized individual the ability to send and receive international Morse code at a speed of five words per minute, along with a written examination encompassing basic radio theory and the rules and regulations of the service. This procedure will entitle the individual to what is appropriately called the Novice or beginner's license. Lest you get the idea this examination is of great difficulty, the youngest person to date to be licensed as a Novice was, in 1976, aged five years. Most hams, however, are between age 15 and 75 and also are truck drivers, teenagers, doctors, lawyers, housewives, etc. We don't, however, lay claim to having a former First Lady within our ranks, but do have many well-known personalities: Senator Barry Goldwater and entertainer Arthur Godfrey, to name two. The licensing requirements do become more difficult, but are commensurate with the privileges bestowed. It is not the intention of the amateur community to exclude any portion of the citizens of this country from obtaining and becoming hams. To this end, the various clubs and organizations, with the help of The American Radio Relay League, conduct free classes to help anyone interested in becoming a licensed radio amateur.

From your article one might infer that sheer numbers is the only requirement for any group to have a larger frequency allocation. I shudder to think what utter chaos application of such a philosophy could have upon the airwaves in a country. You further contend that, should the Citizens Radio Service (CB) be granted more frequency spectrum, it would have to come from the ham radio operators. You fail to mention why this would be necessary, except to say 300,000 against 9,000,000.

To state that personnel of the Federal Communications Commission, because they have traditionally been hams, is like a wolf guarding the flock is irresponsible. The people at the Commission are truly dedicated civil servants.

Your statements about hams controlling more frequencies than all the nation's police and fire departments combined, plus all commercial and educational FM broadcasters, plus all the TV stations on the VHF channels in Los Angeles and New York City is again inaccurate. Had you taken the time to check, you would have found that below 30 Hz, where most of the amateur activity lies, the entire spectrum allocated to the hams encompasses approximately 3.5 MHz. Just one TV broadcasting station occupies 6 MHz of bandwidth, or almost twice the entire high frequency allocation of the entire amateur service.

To state categorically that the hams have a lock on the higher frequencies, which are allegedly free from interference, is again inaccurate. There is still allocated to the Citizens Service a portion of the UHF spectrum in the 460-470 MHz range. The free from interference statement is also incorrect, for no service can be totally free from interference without discipline, regardless of where it is in the spectrum.

It is my objective to attempt to rectify a few misconceptions that you or your staff have about ham radio and Citizens Band. I hope I have been successful. However, should you desire more information, please feel free to contact me.

Barrie L. Schwartz W3ENL
President T-MARC
14413 Ansted Road
Silver Spring MD 20904

73

...tell us you love us

see page 215

IGNORANCE

Mr. Jack Anderson
c/o *The Reporter Dispatch*
White Plains NY

I would like to object to your April 4th column, "Hams Quietly Stifling CBers." It is an unreasonable, one-sided presentation which ignores half the facts. Please consider the following:

1. Far from being an exclusive club, amateur radio is a hobby open to all. To encourage newcomers, amateur radio societies and magazines have for decades published books and pamphlets on how to get started. A stepped-up recruiting campaign to entice CB operators to upgrade to amateur radio has, during the last two or three years, included several book/cassette teaching packages (including one from Heathkit, the nation's largest electronic kit manufacturer), three films, local classes, and spot advertisements on local radio and TV stations.

2. Entry into amateur radio is not difficult; five-year-old kids have done it, as well as 80-year-old retirees. The equipment costs no more than some CB equipment. Ham radio is merely a hobby radio service which legally permits many of the practices presently found illegally on CB. There is nothing to prevent those CB operators who desire more frequencies from upgrading to amateur radio. Hams will welcome them with open arms.

3. One of the major reasons why the Federal Communications Commission has not granted more frequencies to CB is that Citizens Band is presently populated to a large extent by unprincipled scoundrels who disobey every rule in the book, abetted by manufacturers and dealers who make and sell CB equipment designed to violate the law. On the other hand, amateur radio is a largely self-policing service where peer group pressure results in virtually no illegal operation. Are you proposing that the law-breaker be rewarded with more frequencies taken from the law-abiding citizen?

4. It does not take a "confidential report" to conclude that radio amateurs control more frequencies than all the commercial radio and TV stations, etc. Had you merely looked at the FCC regulations, you would have seen that amateur radio oper-

ators are assigned an *infinite* amount of frequencies — everything from 30,000,000 kilohertz and up. Traditionally, ham radio has been assigned all the frequencies above the useful range at the time. It is ham radio operators who have always in the past extended the state of the radio art by finding a use for the "useless" frequencies assigned to them. All the frequencies now used for FM broadcasting, TV, CB, shortwave broadcasting, military, police, fire, and mobile communications, were once considered useless, and equipment for using them was developed by the amateurs.

5. Please keep in mind the differences between CB and amateur radio. Originally intended for point-to-point communications for the small business and personal user, CB has degenerated into a vast party line used primarily for yakking. Psychological studies have investigated the effect of unidentified operation — anonymity guaranteed by the use of "handles" — on the psyche of users; interesting trends have been observed. On the other hand, amateur radio is an orderly service which combines operating privileges with technical expertise. In exchange for taking a technical test, ham operators are permitted — even encouraged — to design and build their own equipment and experiment with its use. Many of the pioneers in electronics and radio got their start through ham radio. In time of war or emergency, ham radio operators have formed a pool of trained operators and technicians. Their contributions have been so widely recognized that almost every country in the world has an amateur radio service.

6. Finally, one might ask whether the cries for more frequencies for CB are really justified. By many estimates, over 50% of radio transmissions are *voluntarily* confined to channel 19. Can't the other 39 channels suffice for the other 50%? Perhaps the way to make more room for legitimate CB use is to crack down on illegal and improper operation, rather than to simply allow it to spread over a greater area. When CB is widely used for evading police radar, perhaps it is time to reduce rather than expand CB bandwidth. Moreover, expanding into inherently short range amateur bands which cannot in any way be policed unless the FCC sets up a nationwide grid of monitoring stations every few miles is only an invitation to further improper use.

Please, next time you write on this topic, consult a ham radio operator for the other side of the story. It will do much for your credibility on unknown issues if you present a fair and unbiased story in those cases where a sizable number of readers are familiar with the facts.

Peter A. Stark K2OAW
Mt. Kisco NY

GOT YOUR EARS ON?

Mr. Jack Anderson
c/o United Feature Syndicate, Inc.

I am sure you will never receive this letter, since I am sure your loyal minions would not allow you to receive mail critical of your column. However, I am so incensed over the above-entitled article ("Hams Hog Airways" — Ed.) that I am willing to use my valuable time in order to attempt to contact you. Therefore, with the unlikely circumstance that you are personally reading this, I would submit the following:

Although I cannot dispute your numbers, which you have quoted, you certainly have failed to understand any of the underlying implications. I hope that your other work does not reflect the same lack of understanding that this article exhibits.

For your information, all frequency allocations for the radio spectrum are set by the International Telecommunications Union, whose offices are in Switzerland. The frequencies which are allocated to hams have been approved by this Union, which is composed of every nation in the world. The frequencies which the CB enthusiasts "enjoy" are actually allocated to amateurs on a worldwide basis. The United States has, in fact, violated this international agreement by providing for the Citizens Band radio service. The original purpose for the Citizens Band has been distorted to the point that it is not recognizable as the Federal Communications Commission originally envisioned it to be. Therefore, the Citizens Band mess should not even exist. It appears that the only reason that there is a problem results from the inability of the Federal Communications Commission to enforce its own rules regarding the Citizens Band. If you don't think there is a Citizens Band problem, listen to the obscene language, the threats of abuse, inane conversatinns, etc., which permeates these frequencies. Also, check with the Federal Communications Commission with regard to the amount of complaints regarding radio frequency interference to home entertainment devices and see what percentage of them relate to Citizens Band operation. At the same time, check with them regarding their proposed rule making which will now ban the manufacture of linear amplifiers even for amateur radio use because the Citizens Banders have been using them, illegally, on their own frequencies. At the same time, you might ask the Federal Communications Commission how many hams they have had to put in jail and how many articles of equipment have been seized as being illegal from amateur radio operators and at the same time obtain the same figures for Citizens Banders. In the same light, also ask the FCC about the term "sliders." You will find that this refers to the illegal practice by CBers of operating on frequencies that have not been allocated to Citizens Banders. These fine people whom you appear to believe should enjoy the good graces of the FCC operate on frequencies assigned to other radio services. Amateur privileges near the Citizens Band start at 28 megahertz. The Citizens Band lies somewhere in the region of 27 megahertz. One megahertz, for your information, is the equivalent distance from the low end to the high end of the commercial broadcast spectrum. Therefore, you can see that there are quite a few "frequencies" available which do not have to be taken from the hams and given to the CBers. However, the CBers have not waited for the FCC to give them these frequencies, since they now proliferate in the region above the authorized CB channels and the 28 megahertz frequencies belonging to the hams. Not only that, these fine citizens are known to occasionally stray onto amateur radio frequencies.

Another item of small import which you have failed to recognize is the theft associated with Citizens Band equipment. In fact, Citizens Banders have so little technical ability that they even steal ham equipment, unusable on their own frequencies, in ignorance, thinking that they are stealing another Citizens Bander's equipment. Of large importance to me is the fact that one of your fine and abused Citizens Banders removed my antenna designed for 144 megahertz from my vehicle just yesterday for his own use. Since it will not operate with his Citizens Band equipment, I hope he has many fine hours trying to find out what is the matter with that "stupid" antenna.

Although CBers get quite a bit of recognition for their "public service" work, that appears to be the only area of justification which they can claim. In addition to allowing citizens to evade police radar, etc., these fine citizens do occasionally notify the proper authorities with regard to stranded vehicles. Hopefully when someone with a CB set reports that they are stranded, the law enforcement authorities appear first instead of their other fellow CBers who come to rape and rob because their victims have identified their location and their inability to escape.

From a historical standpoint, hams have "earned" their frequencies. Although now, because of the sophistication of communication devices and the expenses involved, hams are not as apt to be at the forefront of scientific discovery, a brief examination of the contribution of hams working in their basements on their own time would be illuminating to you, I am sure. From the time of Marconi to the present, many of the pioneers in electronics have been hams. Briefly, Lee DeForest, the inventor of the triode tube, was a ham. Also, the first radio telescope was invented by a radio amateur. It is my understanding that all significant advancements of the state of the art up until the invention of the transistor by the Bell Telephone labs have been made by hams. Hams have pioneered new techniques in television transmissions, bounced radio signals off the moon and have assembled, launched and used their own communication satellites. Hams are also pioneering, today, the field of facsimile transmission, VHF repeater work, and computer-related technology. Hams, because of the licensing structure, must be technically proficient and dedicated. CBers simply have to have ears and a mouth. Quite often the two are not connected. Therefore, as you can see, from a technical standpoint, 300,000 hams have made a significant contribution to the advancement of radio science while your 9,000,000 licensed CBers have since simply caused a pain in the neck to the Federal Communications Commission. Additionally, for your edification, Citizens Banders are not "licensed." Amateurs are. CB operators simply have a permit, which if you bother to check, is quite a significant difference.

In addition to the technical advancements attributable to hams, this pales in comparison to the public service work provided by hams. You have been perhaps too busy to read the newspaper accounts of the communications services provided by hams to Nicaragua, Guatemala, Alaska, and other areas hit by natural disasters. The news services were aware of the fact in the recent Nicaraguan and Guatemalan disasters that for up to two weeks, ham radio operators were the only reliable communications link with these two countries, and the hams were able to coordinate with rescue operations to an extent unmatchable by any other radio service. Don't take my word for it. Check it out. At the same time, you might also contact the disaster agencies responsible for the relief operations in Colorado following the Thompson Canyon flood of last summer and the Teton Dam disaster in Idaho. You will find that hams were at the forefront working many, many volunteer hours to assist in disaster relief operations.

In addition, check with knowledgeable sources as to what the "eye bank net" is all about. You will find that this is an organization of hams who volunteer their own time to coordinate between the agencies responsible for locating donors and recipients for corneal transplants and making sure that the critical time necessary for the removal of the cornea and delivery to the recipient is minimized. In addition, hams maintain contact with the National Weather Service to provide storm warnings for impending hurricanes, aid police departments and provide communications during power outages, and provide many, many other forms of public assistance at times of national disaster. You might also learn, if you take the time to find out, that hams have also spent many hours running "phone patches" from our service personnel in Antarctica, Southeast Asia, and other military installations around the world to their relatives in the United States. All of the above is done without any chance of monetary return, since that is forbidden by FCC regulations.

Additionally, amateur radio operators constituted a vast pool of trained operators for the military during World War II.

By FCC edict, amateur radio exists to promote the communications art, the technical phases of radio, and to provide public service. Please show me, if you can, where CBers are under any compulsion to do anything beneficial to anyone other than them-

selves.

You seem to imply that the FCC has some special love for ham radio. It should, because hams provide so much more service to the public than CBers ever thought of doing. If you do bother to check out the Thompson Canyon flood of Colorado, ask the authorities how the amateur radio operators and the Citizens Banders compared in their ability to effectively assist them in their relief efforts. The news articles we saw in the West indicated that the Citizens Banders were "prima donnas" who got in the way and the amateur radio operators were highly skilled, dedicated, and conscientious in their efforts to assist the authorities.

You apparently suffer from a malaise known to radio aficionados as alligatoritis. You are all mouth and no ears. If you had bothered to do any checking at all regarding the background of the ham-CB question, I am sure you would not have written your article. I would also like to comment that you appear to have been "duped" as you are wont to accuse the federal bureaus assigned to monitor big business. You have been listening to the garbage spouted by the Citizens Band manufacturers and supported by the EIA, all of whom have been pushing to "get more frequencies" so they can sell more CB sets. Shame on you.

Although I have been a ham radio operator for 18 years, I must admit I have not "done my share" to justify my license. However, there is a local woman who was able to talk to her brother and family doctor in Sao Paulo, Brazil, when her mother was dying of cancer, to be kept informed of her mother's condition through the use of my radio. I am sure if you asked her whether or not amateur radio was "worth it," she would answer an emphatic yes. After many times trying to reach her family by telephone in Sao Paulo and sending many telegrams, she was quite surprised that in less than half an hour on my radio, I was able to connect her with her mother's doctor in a hospital in Sao Paulo. On several other occasions, I managed to have her talk to the rest of her family and have them visit about her mother. Upon being informed that the many hours which I spent in her behalf were "free," she was amazed.

On amateur radio frequencies, the above are daily occurrences. The really extraordinary cases are those involving amateur radio operators in remote parts of the world obtaining rare medicines in the United States and having them shipped to the foreign country in time to save a person's life who is in critical condition.

In 1979, the World Administrative Radio Conference will occur. At that time the entire radio spectrum will be reallocated. The black eye which the United States has suffered by allowing the CB mess to develop will hurt amateur radio operators. If that occurs, thoughtless articles like yours will surely attribute to ham radio's loss and ultimately the people of the world's loss. If you are as concerned about humanity as you claim, you will revert your position and use your considerable influence in Washington to encourage the preservation of the amateur radio frequencies.

From reading your column and that of your predecessor, Drew Pearson, I know that you are "never wrong," so I do not expect to see anything in your column reflecting your erroneous thinking. That would be a shame, since you have so many people believing you speak the gospel.

In closing, I would simply like to say, "Hey, ratchet jaw, have you got your ears on?"

Stephen Guelde W7INH
Wheatland WY

RIDDLED

Chicago Daily News
Chicago IL

The April 4, 1977, article on the Federal Communications Commission and amateur radio by Jack Anderson was so riddled with mistakes and half-truths that I have outlined them in red in the enclosed article. Anderson has done irreparable harm to the good name of the amateur radio operator, a reputation that has been earned through over a half century of unselfish service and experimentation.

Anderson insinuates that the FCC is working against the CBers' cause by some secret intent. Nothing could be further from the truth. Since 1971, the Commission has been attempting to help the Citizens Band expand and grow. But the estimated 20 million CBers, half of whom haven't even bothered to get an FCC license, have consistently ignored every attempt at "cleaning up their bands," so that orderly growth can be established. Unleashing these undisciplined, unlicensed radio operators on other portions of the radio spectrum is inviting more television interference, more use of unlawful radio, and an enforcement burden that the Commission cannot possibly handle.

Another Anderson comment: "These (frequencies) would have to be taken from the Ham Radio Operators." This is absolutely false. Megahertz of unused government allocations lie in various portions of the radio spectrum; space set aside for UHF television is almost totally unused.

Anderson: "The Hams also have a lock on the higher frequencies, which are free from interference." I think Mr. Anderson would find it hard to defend his opinion of a "lock" on frequencies by the amateur service, for hams have only 4 megahertz of exclusive use in the entire usable VHF and UHF spectrum, which is 900 megahertz wide. An estimated 150,000 amateurs use this band daily. 79.2% of all usable amateur bands are "shared, on a non-interfering basis" with other services, notably, the government. This sharing arrangement can exist only if both parties are disciplined, state-of-the-art communicators. Sharing was originally tried on the Citizens Band, and it resulted in the "ma and pa" stores and offices, those that could profit most by inexpensive two-way radio, being forced off CB by the personal, illegal hobby user. Would you want to share a band with these people?

And, again, Anderson insinuates that these radio band allocations were all done secretly. Ridiculous! Frequencies are assigned at international conferences after years of negotiations and public dockets. CB interests are represented at these conferences, just as amateur radio is.

None of the FCC commissioners is an amateur, though some of the staff are, but they certainly are not being secretive about it. Most of the FCC hams are CBers, too. And what difference does that make, anyway? If anything, a ham license should be a point in their favor. The amateur radio operator must pass an FCC license exam on radio theory, electronics, and rules and regulations. The fact that some of the FCC staff are hams just proves that these individuals are active in their field of interest. No other radio service allows experimentation and research. Should these individuals be castigated for their interest? Who would you rather have as an FCC radio engineer, a ham or a CBer?

Anderson states: "The opposition to giving the CB industry a greater share of the airwaves has been largely generated by the American Radio Relay League . . . a lobbying organization." Absolutely wrong. The ARRL is not, and never has been, a lobbying organization in Washington. And, in fact, the ARRL has come out repeatedly in favor of orderly CB growth, for many CBers find, after becoming frustrated with the limited range and utility of CB, that they wish to pursue an amateur radio license. Amateur radio wishes CB well, but not at our expense, not at the nation's expense. Amateur radio has turned many citizens on to the world of electronics, has taught them a useful skill, and benefitted the world with more communications breakthroughs than any research facility in the country. And all this has been at little expense to the taxpayer.

Amateur radio is growing by leaps and bounds, and America will benefit from the communications and research skills that are being developed. What new techniques have CBers engineered?

The ARRL indeed has asked its members (through a "flash bulletin"? — be serious!) to prevent the "incursion of CB buffs into their airspace."

The FCC, it so happens, is also quite interested, because thousands of CBers are operating totally outside of their assigned bands, in outright defiance of federal law and international treaty. Amateurs have pledged that CBers will not illegally utilize amateur frequencies, and are working, on their own time, with federal authorities to help track down and prosecute these violators.

Raymond Spence, the FCC's chief engineer, though an amateur, has also made decisions we feel are detrimental to amateur radio too, but we don't hold it against him. He's also a CBer, by the way.

Amateur radio has been the backbone of communications research in this country throughout the twentieth century. This research continues today. Day to day public service is performed by the over one million hams around the world. In emergency situations, hams have often provided the only link with the outside world, via their self-trained and dedicated force of radio operators.

Amateurs are all for CB, but to reassign already crowded amateur bands to "everyman" CB radio, to use as he sees fit, would deal a death blow to the amateur community and in effect reward the CB community for its lawlessness. What a nice way to say "thanks" to what FCC Chief Wiley, who (incidentally) is not a ham, has called "the most disciplined of all radio services."

Mr. Anderson has made a mockery of the term "investigative journalism" and has defaced the good name of the amateur radio service. I only hope that our federal representatives in Washington are informed enough to know that his article is full of half-truths and downright lies, and give it the attention it deserves.

Richard T. Casey WA9LRI
Arlington Heights IL

cc: Jimmy Carter, President of the United States
Sen. Charles Percy, U.S. Senate
Sen. Adlai E. Stevenson, U.S. Senate
Sen. Barry Goldwater, U.S. Senate
Phillip E. Crane, U.S. House of Representatives
Honorable Elliott Levitas, U.S. House of Representatives
Richard E. Wiley, Federal Communications Commission
American Radio Relay League, Newington CT
73 Magazine, Peterborough NH
HR Report, Glenview IL
Jack Anderson, Washington DC

THE UNSAID TRUTH

The *Washington Post*
Washington DC

It is unfortunate that Jack Anderson's column concerning amateur radio is so ill-researched. What is true but unsaid is that the great public service of amateur radio on both a local and worldwide scale takes frequency space, personal and innovative

technology, and selfless dedication. This is in contrast to an untrained, unprepared, and ill-disciplined CB operation which cares not for self-improvement or solutions to its interference and public relations problems. Virtually all of the quarter million amateurs are both able and willing to provide competent, public-spirited, technically clean, and valuable first class service to the public. How many CBers can say as much individually or collectively?

The CB crowd is very vocal about their public service, but what can they really do? By example: On Friday, April 1, I witnessed an automotive accident, radiotelephoned the Alexandria police through the Tyson's Corner WR4ABR autopatch repeater, and had help on the way before an observing CBer could even find somebody willing to pass along the message.

Some research on Anderson's part would have shown a large proposed CB allocation in the FCC's WARC proposal at 900 MHz, a location which does not conflict with valid amateur operations. Perhaps he should do his homework before he writes.

CB is both a valid and valuable means of personal communication, but its services, capability, and reason for existence should not be confused with amateur radio. It is a shame that the *Washington Post* has not informed the public of what amateur radio gave during the Frederick flood, the bicentennial celebration, the recent Cherry Blossom Festival, the Nicaragua earthquake, and the daily accidents on the beltway. Amateur radio is needed both locally and internationally, and before this is forgotten, it may be time for amateur radio to make its voice as loud as its service is strong.

Theodore W. Edwards Jr. W1AJS
Alexandria VA

THE HINT

The *Washington Post*
Washington DC

I would like to comment on the editorial by Jack Anderson and Les Whitten concerning amateur radio that appeared on April 4, 1977. Mr. Anderson clearly distorted several facts and overlooked others in his comments concerning "airspace" allocations for amateur and CB operators. It was claimed that amateurs hold "100 times" the space occupied by the Citizens Band, and that the FCC was refusing to "take the hint" concerning the CBers' requirements for additional frequencies.

Mr. Anderson failed to indicate that the FCC is currently studying the feasibility of additional CB frequencies in the 900 megahertz region — those "interference-free" frequencies referred to in the editorial. Unfortunately, no frequencies remain interference-free when utilized by masses of operators. Mr. Anderson should listen in on the 40 meter ham band some evening, an area rendered almost unusable by foreign high power broadcast stations.

It should be noted that an impassioned plea for additional frequencies by any service, CB included, can only result in the bedlam that exists now on the present CB frequencies. Before opening a new band, a large amount of research into the effects on other users must be conducted. There have been several proposals for new Citizens Band frequencies; unfortunately, most would have resulted in interference to television and other services. There is nothing "confidential" about these proposals and other FCC actions. A simple call to the FCC by Mr. Anderson would have been enlightening.

The FCC does not regulate frequencies arbitrarily. Most amateur frequencies have been assigned by international treaty, and it is impossible for "traditionally ham" commissioners to allocate band space to new services without conforming to international law. A recent proposal for additional CB frequencies was rejected by the Canadian and Mexican government, as interference would have been caused to their services. Unfortunately, radio waves do not adhere to national boundaries.

The FCC *has* taken the hint, and is attempting to find new frequencies for CB use. It is not the CB operator who is harassing the FCC commissioners; it is the manufacturers of CB gear looking for additional profits that will result when new bands are opened. No mention of the operator was made in the editorial. It is this person who will bear the expense of new equipment and antenna systems when new bands are allowed for CB use.

In conclusion, it is important to note that Mr. Spence of the FCC, the American Radio Relay League (ARRL), and the 300,000 hams were powerless to prevent the loss of 99% of their bands when a recent international conference eliminated most of the "interference-free" satellite bands once available to amateur operators.

John W. Molnar WA3ETD
Executive Editor
73 Magazine

ONE SIDE

Enclosed is a column from the *Miami Herald* of April 4th, and, just in case you do not get this Jack Anderson syndicated column, I wanted to forward it to you.

I feel that some knowledgeable individual, such as Wayne Green, should write to Mr. Anderson outlining all the benefits and good that ham radio operators have done for the last fifty years. It would seem that he is getting just one side of the coin from this article.

Personally, I think that the CBers should be given one of the UHF frequencies — and let them have their fun. Maybe that will keep some of them from operating illegally in the ham bands or from becoming two meter technicians and carrying over their poor operating techniques into this operation.

Nevertheless, Mr. Anderson should be rebutted because of the distortion and obvious impact this could have on the general public.

Frank Nankin K4BNZ
President, Palmetto Amateur Radio Club
N. Miami Beach FL

BAD PR

I'm sending along a xerox copy of an article published in the *Rockford Morning Star*, April 4, 1977, written by Jack Anderson, the noted (??) columnist. It shows how much a guy can twist facts and how much he knows about ham radio.

I'm asking *every* ham to let this guy know what ham radio is, the public service that's been done, and how twisted his "confidential report" is.

His address is c/o United Feature Syndicate, 200 Park Ave., New York NY 10017. Give this guy a piece of your mind because this is bad PR for ham radio, especially with WARC coming up.

Tom Carney WB9RXJ
Sterling IL

CROSS POLLINATION

Just a quick note to thank you for the "Briefs" column by WA1GUD and WA1UMV. We have long needed a forum for "cross-pollination" of ideas from various clubs throughout the country. This can only result in a more informed, healthy, and active ham radio fraternity. "Briefs" fulfills a need, and I, for one, thank you for it.

Rich Casey WA9LRI
Arlington Heights IL

TOP BAND

I'd like to see an article on the pros and cons of 160 meters, along with some details relative to the construction of antennas for this band.

L. Lyle Baker K5QJT
Mineola TX

Glad you mentioned that. This issue has a feature article on the King of 160, Stew Perry W1BB. A new 73 *book,* The Challenge Of 160, *is hitting the presses in a few days. Stay tuned for some great 160 articles in coming issues. — Ed.*

TRIGGERED

Yes, we did receive a refund from Trigger Electronics, the same outfit that we all seem to know about. It wasn't easy. Our problems with them were almost the same as those described by Mr. David B. Hasenick of Springport MI.

We wrote many letters, both to Trigger and then to the Illinois Attorney General's Office. Trigger responded by sending us small lightweight items in large boxes. The airmail postage was almost double the cost of the item. Then after several more letters to the Attorney General's Office with copies to Trigger, we finally received our refund of the balance.

Several months later I received a letter from the Attorney General's Office advising me that the State of Illinois was going to prosecute. The details of the letter were made available to Wayne Green. I had hoped that he would place it in the "Letters" section so all could note the contents and then write to the Attorney General Office and perhaps receive a refund in the coming court action.

Red Stolle W6OHN/MM
Lajas, Puerto Rico

PR THROUGH PS

During the recent East Greenbush-Castleton (NY) area March of Dimes Walkathon, members of WB2YCR, the Amateur Radio Club of Maple Hill High School, were involved with the communications along the walk route and even operated a portable station on battery power.

Actual communications along the route were provided by the Rensselaer County RACES/AREC Association, of which I (the club's sponsor) am a member. I set up communications at one of the checkpoints along the walk route and allowed students to listen to the RACES communications as a means of demonstrating the use of amateur radio in public service, for which the RACES organization is famous.

At the same time, another portable radio station was set up under my direction by student radio operator Geoff Schad WB2EQN. This station operated solely from a 12 volt battery provided by media staffer Stuart Hague. The antenna used was a twenty meter dipole set up on portable supports. Using this simple rig, Geoff was able to talk with several stations, including two in Florida (W1BDF/4 and W4QC), WBØSMK in Lincoln, Nebraska, WBØCHH in Springfield, Missouri, and K4APL in Perry, Georgia, all during the Walkathon.

The Walkathon provided two golden opportunities. One, to provide a public service through RACES, and secondly, to test our club station's portability. It also provided valuable portable operating experience for Geoff and our student operators.

J.F. Kienzle WA2UON
Castleton NY

HELP ABROAD

I just received my March *73* today and noticed in the "Ham Help" section a couple of more articles from individuals requiring help while overseas.

One article asked, "How can I get a license overseas?" The FCC has been coming to Europe (Ramstein AB, Germany, and Mildenhall RAF, England) every six months for the past year. They were here March 21, 22, and 23, and should be back again in September. Most MARS stations and education offices will have the exact information in July or early August as to the dates of arrival.

I have also been asked a number of times, "What kind of American activity is there in Germany?" Answer — "Everything." In Germany all US forces and dependents can obtain a German license very easily. All that is needed is an address (operating location), a valid stateside license, Technician or above, and 39 DM ($16) a year.

Activity within Germany is in almost all modes of operation. As a General or above you will be given a German Class B License. With this license you can operate up to a maximum of 150 Watts plate dissipation on any of the following frequencies — 160m by special permission, 3.5-3.8 MHz, 7.0-7.1 MHz, 14.0-14.35 MHz, 21.0-21.45 MHz, 28.0-29.7 MHz, 144-146 MHz, 430-440 MHz, 1250-1300 MHz and more above. All the above frequencies may be used in the following modes — A1, A2, A3, A3J, F1, F3.

These modes are for the entire band. There are no class or subband allocations. There is a great deal of repeater operation on 2m and 70 cm. Universally within Germany, 145.500 MHz is a mobile calling frequency and 145.525 and 145.550 are simplex.

There are a number of American amateur radio clubs within Germany. I could go into each of them, but a visit to your area MARS station will render you information about clubs in your area. I am a member of the Wiesbaden Amateur Radio Club, so, being biased (hi), I will say a little about it. We meet the second Tuesday of every month at 7:30 pm, and of course everyone is invited. Most club members can be found on 145.550 MHz FM.

Any interested person can write to The Wiesbaden AB, MARS Station, APO NY 09457, or myself, and we will try to answer questions and offer assistance to individuals about amateur radio within Germany.

There are also radio theory and code classes being held on Rhein Main AB and Wiesbaden AB, continually. I would imagine with the amount of American activity, there are many other classes being held. Again, visit your local MARS Station.

Jerry E. Cole DA1JC
Box 4115
APO NY 09057

CT7001 FIX

I greatly enjoyed Mr. Kufchak's article on "The Super Clock" — using the "old" CT7001. I used the same chip in my clock which has been running fine since 1973. Well, actually, there is one minor problem or I wouldn't be writing this!

Every so often, while in the 12 hour mode, the pm bit in the time or alarm register (or even both) gets set. (So, instead of waking up at 7:00 am for work, one sleeps through until dinner time!) I'm pretty sure the problem is in the chip (and, therefore, extremely difficult to correct), but I'd like to know if others who have used this chip have a similar problem, or if this is an isolated case. Any feedback would be appreciated.

Oh, as a suggestion for battery backup, use the "display enable" line to blank the display to conserve energy, and use a blinking LED or something similar to indicate loss of 60 Hz.

Roy Weidig
513 Lamplight Ct.
Middletown OH 45042

THE REAL ONE

When I picked up my first copy of *73* (OSCAR issue, July '75) in Hong Kong, I realized that it had to be the only real "amateur" magazine on the market. The others merely label themselves as such. I don't believe any other magazine has the coverage *73* does. During a recent overseas deployment, I saw book peddlers in Karachi, Pakistan, Subic Bay (Philippines), Singapore, and Hong Kong selling *73* — and they were the current months' editions! Never saw any other ham publications anywhere except in U.S. possessions. In my opinion, *73* has improved steadily since I first bought one. I noted the greatest improvement when the magazine went to the large format in '76.

Most of the time I'm in agreement with your opinions and definitely agree with and appreciate your openness to other opinions.

Keep the I/O section going (I realize you have no intention of ending it). It's great, as is *Kilobaud*. Both serve their functions well.

Thomas C. Johnson WB6NQK
FPO San Francisco

THE SEARS DEBATE

WA4MZL's letter about "Sears and 2M" on page 17 of the March, 1977, issue prompted you to comment, "We're on the case!" Factors to consider in the "case" should also include one or more of the following:

1. The Sears Spring/Summer 1977 catalog, page 967, actually tends to encourage CBers to move up into the ranks of amateur radio with its heading — "Ready to go beyond CB? Enter a new world of communications . . ." The "Important Note" puts the uninitiated on notice that there is a requirement that the user must be duly licensed and further refers potential users to the FCC for further details. How's that for educating the public? Could be better, you might say? Why not help Sears with their later catalog copy?
2. The ownership of equipment is an incentive. A friend recently purchased a 2m walkie and has so far twice failed his exam. He at least has the monetary incentive to push on. Incidentally, he purchased the rig from one of *73*'s advertisers without proof of a license required, and if *73* is not a catalog, mail-order sales operation, I miss my guess.
3. As indicated in "Briefs" in the same issue of *73*, the photography industry benefitted from new markets through mass availability of the products. I agree that "A vastly larger distribution network for amateur products could possibly create enough demand to give amateur radio thousands of new devotees." How about PRing many of them onto 220 and 70 cm?

As you may have gathered, I am interested in encouraging the CB members of our radio family to join our ranks — legally! To that end I wrote this letter.

Skid Schermerhorn
W1TTY/W1IOY
Wellesley Hills MA

P.S. The Sears by Yaesu looks to be functionally the same as my (purchased by mail from an ad in *73*) Wilson WE224 by Yaesu with which I am very pleased. Maybe the Sears should be reviewed in "New Products." Who knows? If Sears sells only a few of these radios, they might have a drastic price reduction and create a great bargain for many of us.

SWIFTSURE

I have been a reader of your "Letters" column for many years, and needless to say I enjoy it very much. Its contents have prompted me to write.

In the Victoria area (southern tip of Vancouver Island), the Royal Victoria Yacht Club holds the Swiftsure Sailing Classic race. As a PR venture, the Amateur Radio Clubs of Victoria and Port Angeles (Washington State) are combining efforts for the second time to handle emergency communications.

The Swiftsure Race is known worldwide and affords an excellent opportunity for publicity. We have close to 100 hams involved in 4 land-located positions, and we also equip 5 power vessels with units for patrol purposes. Communication is via the Victoria Repeater (25/85), with HF used for long haul and backup.

There are usually at least 350 sailboats involved, from both the US and Canada. Their route is west out of Victoria through the Straits of Juan de Fuca to the open waters of Swiftsure Bank, and then back the 80 miles to Victoria. To give an idea of the conditions at sea, the wind at Swiftsure Bank was 45 mph last year, with a 22 foot sea (we have an operator who doesn't get sick). The turn boat is at anchor for at least 24 hours. In closer to Victoria the water conditions change by the hour, sometimes with no wind, other times with wind and rain.

The amateur radio enthusiasm is unbelievable. To give you an idea, last year this year's planning began the day after last year's race!

73
Study Guides and Code Tapes — The Best Available
see page 220

This year's Swiftsure Race is May 28 and 29, and we hope it will be a success.

A.L. Muir VE7BEU
Victoria BC

SOCIALISTIC CB?

Many CBers advocate that they be given privileges normally associated with amateurs. Maybe I'm old-fashioned, but I was taught that people were expected to earn the things in this life that they wanted to receive — whether it's a pay check, more frequencies, or more power.

I don't believe I'm disillusioned. We amateurs at least partially earned our licenses by diligent study and practice to obtain our licenses. Many times I have heard the expression that no one respects anything given to them. I observe that this is also true in regards to CBers as well as welfare recipients. Neither respect what was given to them and only cry for more.

The CBers who use ham frequencies and run high power, disregarding the law, are the same as someone who is denied welfare and steals because he feels it is owed to him.

Unfortunately, this reflects an attitude sweeping our nation. Until it is changed, our society will continue on a path of socialistic decline.

Harold White WA4CPF
Birmingham AL

CRAZY

I wanted to say that I enjoy reading your magazine. I'm not too crazy about all the computer articles, but I wasn't too crazy about 2 meter FM a few years ago when you were pushing that idea. Now I have two 2 meter FM rigs.

I'm also very glad that you're around to keep people on their toes! Many times, when I read your comments or answers to some of the letters you get, I find they reflect my exact feelings! I definitely do not feel, as I'm sure many others do not feel, your last name reflects your character (e.g., the letter "The Golden Helmet," Jan. '77). I think you hit the nail right on the head more often than many would like to admit!

Also — a special thanks to Don

Jenkins WA6OAZ for the fine article on getting 88 channels with 2 switches on the Icom IC-22S. A fantastic article, as many of the articles in *73* usually are!

Finally, as far as good experience with manufacturers goes, I must put in a good word for Amateur Electronic Supply. I've been dealing with them for about 4 years now, and haven't had anything to complain about. Ray Brenier K9KHW is always very pleasant on the phone and very helpful. Their used equipment has always arrived in mint condition. Great service on new stuff, too.

Dave Buda WA2RYC
Nutley NJ

TVI IS CURABLE!

I am interested in knowing any hams interested in reactivating 6 meter AM (in the metropolitan NY-NJ area). I am 16 and have finally acquired my Technician license (I didn't think I would ever reach the ranks). So c'mon fellas and/or YLs (TVI is curable). Drop me a letter and let me know. There have to be some 6m AM rigs around and I only own an AM rig, so it's only fair for myself. So let's hear it!

Kenn Ramirez WB2KQO
675 Knickerbocker Ave.
Brooklyn NY 11221

Watch out, or Ch. 2 will get you! – Ed.

10M CB

In regard to the proposed 10 meter frequencies published in the "Letters" section, how about moving it up 5 kHz so the converted channel 14 would be 28.715 and now be on the 10-10 net frequency? Perhaps this would encourage 10 meter operators to convert a radio to use from home or in the car on the net. Help promote 10 meter activity!

Douglas Reed
St Paul MN

FREE CLASSES

The Flushing (NY) Radio Amateur Technical Society is sponsoring *free* licensing classes in the Flushing area. For more information, drop us a postcard: FRATS, 62-26 Boelsen Crescent, Rego Park NY 11374.

Stu Weinstein WA2BXJ
Rego Park NY

LLOYD AND IRIS

We have just completed operation as W6QL/VP2A. We made 10,000 QSOs with hams in 126 countries. This is an all-time record for our various stops. The large number of

Lloyd (W6KG) and Iris (W6QL) Colvin at VP2A.

QSOs was due, in part, to participation in the first weekend phone and the first weekend CW portions of the ARRL International DX Competition. We made nearly 4,000 QSOs (before eliminating duplicates) in the 48 hours of operating in the phone contest. This is the largest number of QSOs we have ever made in 48 hours. We remember world-famous contest operator Jim Neiger W6BHY telling us that in one contest he made 4 contacts a minute for an hour. At the time we did not see how it could be done, but we did almost the same thing in the contest just concluded.

Band conditions have been excellent. For example, we worked all continents in 30 minutes on 14 MHz SSB on 21 February 1977. Stations worked were UF6VAG, VK4AK, YV4YC, IK7RNH, XE1DPF and ZS6DN.

Lloyd Colvin W6KG
Iris Colvin W6QL
Antigua, W.I.

DVM FEEDBACK

I've been following Wayne's career, through the mags he publishes, for quite a few years. I must say that I enjoy *73* very much, especially the article on VR6TC and the mention of KV4AA. In 1956 I used to be VP2LB, so I know what it is like to be DX. Now I am settled in Canada and just about ready to be a VE3 after many hectic years in this country.

The main reason for writing this letter is to clarify some errors on page 60 (Fig. 1) of the Feb 77 issue ("DVM's Get Simpler"). Seems that Gary McClellan, in trying to straighten out the errors in that schematic (in the April '77 issue, p. 17), has introduced more errors. C3, the .01 uF, should move to pin 10, not 9; also the 10k resistor R3 should be between pin 10 of IC2 and pin 7 of IC3. Also, C2, the 47 uF capacitor, shows the wrong polarity. Positive should be on pin 7 of IC2.

Boris Auguste
Hamilton, Ontario

HORRIFIED

I recently received the April, 1977, issue of *73 Magazine* and was horrified to read "Those Illegal CB Channels" by John Skubick K8ANG. I am appalled that your magazine would condone such illegal activity.

My value system is such that I cannot support any publication which condones and even suggests illegal activities.

Therefore, cancel the remainder of my subscription to *73 Magazine*. I shall expect to receive a prompt refund for the cancelled portion of my subscription.

David A. Deem WA3ZXI
Rosemont PA

Please reread my article again, word-for-word. It is fact-filled objective reporting, written in a somewhat sarcastic vain. We hams, as a group, have always conducted ourselves within the law. (I, for over 22 years.) Yet we are constantly being harassed (such as by incentive licensing), and now possibly by restrictive designs placed upon our low band equipment, due to CB related activities.

Yet, the 11 meter band has been expanded to further accommodate some of what was once illegal. More channels have been added, and the rules are relaxed.

Speaking of that word "illegal," it is used throughout my article, including the title. This is the only word I know of that means "unlawful," "forbidden," and "not condoned." Don't you agree? – K8ANG.

LOOKING WEST

While your "Looking West" column is one of my favorites, I take great exception to WA6ITF's comment that there "was not a repeater to be had" while traveling through our Central Coast area. We do have excellent repeaters with lots of activity. Perhaps the machines are a little bit on the quiet side on a Sunday evening, but the times are rare that you can't put out a call and make a contact. Perhaps he should have tried "kerchunking." "Kerchunk" is the sound of a falling squelch tail brought on by a quick flick of the mike button. Of course, one should identify when doing this. Kerchunking 16/76 in San Luis Obispo would have brought to life WR6ADS, Cal Poly's local machine.

Also in SLO you will find the Central Coast's oldest and widest coverage machine, WR6AEL on 22/82. A little twist of the dial, another kerchunk, and up will come our newest repeater – WR6ASW. Located in Santa Maria, this machine covers from San Luis Obispo to the top of the San Marcos pass near Santa Barbara. As designer, owner, and trustee of this machine, I fought hard to get a good site and the best frequency pair, none other than the granddaddy of them all, 34/94. 34/94 was chosen to make the machine useable to a maximum number of persons, transients included.

Traveling south from SLO, one soon comes to beautiful Shell Beach, and while its excellent restaurants are enough to make most of us forget radio for a little while, an insistent kerchunker will discover Lompoc's own WR6AVI on 72/12 – an excellent repeater with coverage almost to the Gaviota tunnel.

In summary, one with only common channels in his radio will have 3 or 4 repeaters to pick from in this area, while those with full coverage can pick up Nipomo's WR6AHZ on 81/21 or WR6AFI on 60/00 with coverage from SLO to Thousand Oaks. All of our machines are carrier access, on the air 24 hours daily, and fully open to all licensed amateurs. We have open autopatch on three of the machines with exchanges covering Los Osos, Baywood Park, SLO, the Five Cities, Nipomo, Santa Maria, Los Alamos, Vandenberg, and Lompoc.

Regarding operation on other bands, WR6AEL has an open 450 repeater as well as a 450 system that controls a 52.525 radio. By the time Mr. Pasternak makes another trip through this area, WR6AHZ's 220 MHz system will be operational, and two open 450 systems in Santa Maria will be operational, one from the WR6ASW site, although our 450 frequencies will be per the national band plan, not the upside down Southern CA plan. Other things being planned but not presently operational include adding a 6 meter receiver at the WR6AHZ site with a 450 link to WR6AEL's 6 meter transmitter to complete a 6 meter, split site repeater on the most popular 6 meter channel per the national band plan.

While we do have good equipment on the air here, we also have good users. We do not need tight controls. Our autopatches are fully open and the codes are published. A high percentage of the local hams even have the repeater control codes. Most of us are not the "new breed." Many of us were rag chewing on 75 and working DX on 20 before we ever heard of a repeater. Several of us are members of QCWA and several of us are in high

school or college. Q signals we understand, but few of us know the difference in a 10-7 or a 10-8, and we are not interested in learning. We have no jamming, no attempts at long distance calls on our autopatches, and we jump to answer a distress call.

The point of this letter is that the Central Coast is not an rf desert. We welcome and encourage transient traffic on our fine repeaters. If you can't work our repeaters, we will even help you build a decent antenna.

Robert C. Couger
Santa Maria CA

THE POWER DEBATE

My comments may not sit too well with some equipment manufacturers and the "big boys," but perhaps the forthcoming ban on commercial linears is a blessing in disguise. Why does anyone need more than a couple of hundred Watts anyway? The only reason that I have found in over twenty years of hamming is to punch through the other signals, with the result that you are probably being heard not only by the person(s) you are in contact with, but by most of the country as well, and causing unnecessary QRM to boot. If the power limit was, say, 200 Watts pep on the high frequency bands, think of the reduction of QRM. Sure, there would still be the same amount of signals, but the level of QRM would be so greatly reduced that working around it would usually be a breeze. The great power myth is easily disproved by listening on the bands in the wee hours when most U.S. hams are grabbing some ZZZZs and hear the DX stations running one or two hundred Watts roll in. So the idea being put forth by some that all the new rigs would have to be expensive high-powered ones is possibly just a manufacturer's dream.

There would be some spinoff benefits from such a power limitation, such as a reduction in energy use and shifting the frustrations of not being able to compete with the super power from the average ham to the ex-super power ham who in most cases can better afford psychiatric care.

I doubt if such a power reduction will ever take place, but if it should, I wouldn't shed a single tear as I dismantle my trusty linear.

Harl Goodwell K6JQD
Paradise CA

You touched a sensitive point, Harl! I have always been dismayed by the use of excessive power on our bands. Possibly it is because I am not a seasoned DXer — sometime I will get into serious DX and my philosophy might change. However, while in college, I worked WAS minus two with 50 Watts CW, and it didn't take forever. With the abundance of good antenna designs around, it is a shame that more hams don't take the time to erect "superior" systems (apartment dwellers aside!). The same theory applies to VHF and UHF. Recently I have been involved in 432-450 MHz experimenting, and it's amazing what can be done with low power (under 50 Watts) and a good antenna/preamp/transmission line setup! The current crop of 2m transceivers all have fantastic receivers — a fact that reduces the amount of power required for dependable communications. I often wonder what it would be like if there was a universal 250 W power limit on HF communications. It might be interesting! High power is required in certain applications, such as EME, but should be employed only when necessary to maintain communications on HF, and I don't mean when blasting through a pileup on 20. I would like to hear from others on this subject — I'm open to criticism and will gladly open the letter forum to comments. — Ed.

20M QRM

The other day on 20 meters I had been monitoring the Intercontinental Traffic Network, in hopes of being of help to someone somewhere. A W5IH(?) station operating mobile in New Orleans began calling CQ on the frequency. There must have been at least 100 stations listening on that frequency. He was asked to move off and got very indignant about that. He continued to operate and QRM the net.

He said that he was sick and tired of all these nets on 20 and would not QSY, as he did not give a damn. I wonder what he thought we actually are about. I would like to publicly explain to him what we do and accomplish for us and him — yes, him!

First of all, one of the main reasons we hams are licensed and are allowed to be on the air is that we are here to promote international goodwill. When we run phone patches and other types of traffic, we certainly serve to further international goodwill, not only between other hams but to non-ham individuals as well. How much international goodwill did he render to his country by calling CQ and working a W8 station and exchanging signal reports, while people in maybe 20 countries were QRMed? We don't wish to take any fun away from anyone, whether he runs DX, SSTV, CW, mobile, etc. But please, try to cooperate with us, who enjoy running traffic. We have to share the band also. Remember that without a netting frequency to congregate onto, there would be hundreds more transmissions going on by people looking for connections somewhere — resulting in even more QRM on 20 meters.

By running traffic we are fulfilling one of our requirements for receiving our tickets. Please work with us, not against us. Use your energy to improve our bands. Maybe you could start a drive to clean up splatter, or perhaps work together to open more frequencies. There would be less QRM and more enjoyment, as we pursue our pet preferences in this wonderful hobby.

Chet Brown WB2AHK
Woodhaven NY

HOME BREW

As a home brew fanatic, I am constantly involved in those guerrilla wars we have all reluctantly come to accept as a way of life when venturing into the marketplace. It's been more years than I'd like to remember that I've been searching for dependable vendors, and any day now I should be receiving my battlefield commission.

I write up many projects and have had my share of pages in the ham magazines. The point is that a single article can sometimes result in literally hundreds of inquiries from interested readers who, for the most part, want to know where they may obtain parts for a project. I very rarely answer with a specific name, as I've learned from experience that I'd be making more enemies than friends.

Whenever I try a new supplier, I send him a small order just to see how it turns out. If all goes well, I keep this place in mind for the next time I need his kind of merchandise. If my order receives shabby treatment, however, I scratch the name from my list.

The candid "Letters," reporting personal experiences that other readers have sent to this column, are quite helpful and a sorely needed service for the harassed consumer. However, the results are not always consistent. After reading a favorable report on Quest Electronics, I sent my usual "test" order for $8.90. After waiting a month, I wrote a letter canceling the order and requesting a refund. I was not even extended the courtesy of a reply. I wrote again 3 weeks later and subsequently received a partial refund. This meant another letter, inquiring after the remainder of the money I had sent for parts they didn't even have, and which were still being advertised months later. (Too bad we can't claim expenses and compensation for all the aggravation.)

Perhaps we should start a "preferred vendors list." Anyway, I've put in my two cents worth, and with inflation it is worth even less, but I do feel a little better for having done so.

Raymond Megirian K4DHC
Deerfield Beach FL

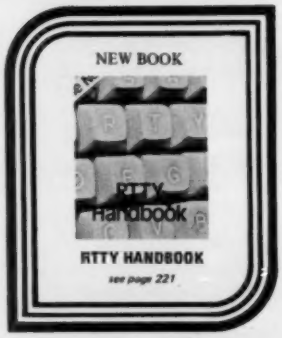
THE RFI BILL

Senator Adlai Stevenson
United States Senate
Washington DC

Since moving to Illinois I've never written to you, but a bill recently introduced in the Senate is of vital interest to me, and should be to all Americans.

I am writing in vigorous support of S-864, Sen. Barry Goldwater's RFI (Radio Frequency Interference) bill.

I speak from experience, as both an active amateur radio operator for over 15 years, and as a TV and stereo buff for even longer. As a ham, my equipment has always been "clean." Yet, I've faced all sorts of harassment from my neighbors because of interference to their TVs, radios, and stereos.



Repressive local laws against any amateur or CB operation are beginning to appear. It's not our fault, in the main. It is the fault of shoddily built equipment for home entertainment, which all my neighbors own.

Look at it this way — one of the major intents of the present administration is for human rights, as expressed in our Declaration of Independence and designed into our Constitution: "The right to Life, Liberty, and the pursuit of Happiness." If that pursuit of happiness is not at the expense of someone else's pursuit of happiness. In other words, I have the right as long as my signal is clean, to pursue my happiness by operating my amateur radio station, as does my neighbor to watch "Mary Hartman" or the Super Bowl. We really should never know of each other's existence. But (1) when my operating signal destroys his picture or sound, even though I'm operating a properly designed and adjusted transmitter, and (2) when various signals from my neighbors' TV sets interfere with my reception, which they do, then (3) something is wrong.

My neighbor himself is not at fault. But he paid $450-$900 for his home entertainment set, and he expects and thinks that that set should be designed and constructed much better than it is.

And so it should be. It must be, because the home entertainment equipment industry's quest for life, liberty, and the pursuit of happiness, via higher profits, is infringing on my rights and the rights of my neighbor, the consumer, to each do as we wish, because of their cheap design and shoddy construction techniques. It just isn't fair, pure and simple.

I believe that S-864 is a major step, a good start in the right direction to the day when all radio operators and TV/stereo lovers can live in peace in the same neighborhood.

The home entertainment equipment industry is not about to agree with any of this. Through their lobbying group, the Electronics Industry of America, they are expected to greatly oppose this bill. They will claim that the cost of properly designing and shielding their devices against RFI would be prohibitively costly. They said the same thing about the all-channel set law in 1964.

It proved to be a fallacious argument then, and still is, particularly in

Continued on page 42

Briefs

Compiled by Warren Elly WA1GUD

Got a good ham radio news story? Drop us a line, or call it in, and take home the 73 publication of your choice, provided we publish your news tip. Be sure to specify which book you want. OK?

At deadline: AMSAT reported a successful 2m CW contact between KP4AST and YV5BUK . . . over 500 miles between Caracas and Ponce. A fourth 432 MHz EME WAC is also reported by K3PGP, who completed the all continents award with ZE5JJ. May 2nd at ARRL headquarters, AMSAT officials were planning their first A-O-D operations meeting since both groups signed an agreement turning control of OSCAR 8 over to the League. Topics to be discussed reportedly included allocation of the new satellite's passband, with many OSCAR users advocating a CW-SSB division similar to OSCAR 7 mode A. FCC license totals for CB (February) were nearly 700,000. Some Russians may be signing U60 in commemoration of the 60th anniversary of the October, 1917, revolution. The Fresno International DX Meeting drew the biggest crowd ever — over 350 DXers from far and wide. And, congratulations are in order to the beloved *West Coast DX Bulletin* (the source for the last three items). At Fresno, the *Bulletin* received two awards, one from the Southern California DX Club and another from the Golden Empire Amateur Radio Society. At last report FCC lawyers were still sorting out that cable TV case mentioned in one of this month's guest editorials. One FCC spokesman on the matter of what will happen at the Dayton FCC Forum: "We will be pretty close mouthed until more explicit instructions come from higher up . . . we will discourage discussion on pending proposals, and make a written record of the Dayton Forum for the public files on various dockets."

Jack Anderson's national newspaper column strongly criticized the FCC and left amateur radio with a PR problem under a "Radio Hams Are Favored Over the CBers" headline in early April. Unfortunately it was not an April Fool's joke — Anderson, citing quotes from Georgia Congressman Elliott Levitas, accused the FCC of discriminating against the 9 million CBers in frequency assignments, in favor of only 300,000 amateurs. Anderson's case rested on his claim that important decisions by the FCC have been made by officials who are also amateurs, and therefore biased against CBers. One FCC official termed the report "a frivolous allegation" not worthy of comment. Congressman Levitas, though, is pushing for a House investigation of the FCC. (See Guest Editorial this issue.)

Bob Hope has generously recorded some public service announcements pointing out to the public that amateur radio is valuable to the nation, inviting those interested to "join in." These will be distributed to radio stations, adding to those already being heard which were made by Dick Van Dyke. Thanks to W6NAZ.

Another record month for amateur applications arriving in Gettysburg . . . 22,927 received during March, topping the January record of 21,553. However, the backlog is growing, instead of falling. At the beginning of March the number of licenses awaiting processing was about 38,000. By the end of the month, the backlog was up to 42,000. The waiting period, meanwhile, had grown beyond 10 weeks in some cases, with the average wait somewhere near 8½ weeks.

The ARRL has filed in opposition to RM-2830, that proposal to permit rebroadcasting of amateur transmissions for traffic and emergency purposes over commercial stations. ("Briefs," May '77, *73*). In its response, the League argues that road, traffic, or weather information could not be of benefit to a commercial audience without a two-way system for clarification of the information being filtered into the studio. That, of course, would take a licensed amateur station at the broadcast studio, a requirement broadcasters would be hard-pressed to meet due to commercial considerations. The League also points out that amateur transmissions would be used in heavily commercial time periods, so-called drive times, when broadcasters not only have their largest audience, but also their highest advertising rates. Backing the WBEN plan was the National Association of Broadcasters (NAB). The League response noted that the NAB was not familiar with amateur operations, and sought to exceed reasonable limits for questionable benefit, in backing RM-2830. Buffalo area amateurs, meanwhile, were upset by the League opposition. Said one local (heard on 75m), "This isn't the time to split hairs when ham radio so badly needs better access to the public for PR . . . " As pointed out, however, in the League petition, unusual circumstances (such as disasters and so on) do allow rebroadcast of amateur transmissions, with the permission of the district FCC engineer-in-charge.

It will probably be some months (as of this writing) before the total scale of amateur operations in spring floods and tornadoes will be known. Virginia, West Virginia, and Kentucky were hard hit by floods and mudslides. Local communications went down quickly, especially in WV, where amateurs set up a communications center at the state capital, operating on a 24 hour a day basis. It took as much as 48 hours in some areas before National Guard units could arrive, and amateurs were reportedly working closely with local police using HTs and those repeaters that could be coaxed back onto the air. At Williamson WV, residents were warned of the flood by the local fire whistle, the only form of communication left as the waters crested. In another WV town the mayor was carrying a pistol to discourage looting, he told NBC News, since it would be days before help arrived. In Alabama, tornadoes tore through Jefferson County, three years to the day after the last killer storm there. Amateurs in Birmingham operated W4CUE continuously, handling traffic from the disaster areas.

There were some new developments on the FCC's proposal to ban the manufacture of linear amplifiers covering 24-36 MHz and type accept amateur radio equipment (dockets 21116 and 21117). At issue is the need for point of sale constraints on the sale of equipment to non-licensed persons (a concept the FCC had rejected). ARMA, the newly formed manufacturer's association, reacting to a counterproposal from the San Antonio Repeater Association (see "FCC," this issue), argued that the Texas plan would probably violate federal restraint of trade regulations. ARMA's proposal differs from the San Antonio plan in one key area — it puts the onus on the manufacturers, not the dealers.

The ARMA plan would require all manufacturers and importers of rf generating devices to affix permanent serial numbers and provide affidavits. The affidavits would be presented to the buyer by the dealer, who'd have to see a valid amateur license (or photocopy) prior to closing the deal. The seller would witness the signing of the affidavit, which would include the type of gear, serial number, call letters of the buyer, his name, and a statement of intent covering the subsequent use of the gear. A willful violation of the agreement would carry a $1000 fine on the buyer, dealer, or manufacturer if the FCC found any party in violation. A copy of the agreement would go to the FCC, dealer, manufacturer, and buyer, and, just like a station license, the affidavit would have to be presented upon inspection by FCC personnel. As an ARMA spokesman put it, "this plan offers fewer loopholes than the FCC's type acceptance plan, and would meet the constraint of trade regulations of the Federal Trade Commission.

One importer, in a letter to its dealers, argues against type acceptance as harmful to amateur radio. "Experience with type acceptance in other services is illuminating. A typical amateur transceiver in the 250 W (PEP) class today lists for between $575 and $900, depending on options and manufacturer. A comparable marine transceiver, type accepted, lists between $2000 and $5000, and lacks many of the technical advances found in current amateur transceiver." It

may be assumed then, that type acceptance of manufactured amateur equipment will increase its cost to the consumer, and that innovative changes will be much slower in being produced, just as in other services." The dealer's letter goes on to conclude that "since type acceptance is now desirable only as a solution to a Citizens Band misuse problem, it is beyond our understanding as to how the Commission can expect to keep high powered, illegally converted transceivers from such use, by inspecting them for purity of emissions."

A 90 day delay was announced in early April, extending the comments deadline for both dockets until August, thus opening the door to more amateur comment.

As this issue went to press, ARMA, the Amateur Radio Manufacturer's Association, was delivering an 11th hour appeal to the FCC . . . hoping to soften the first rule and order growing out of Docket 20777 (bandwidth). Effective April 15th, new harmonic and spurious emissions limits were to take effect for amateur transmitters. The 40 dB limit below 30 MHz/60 dB above 30 MHz standards replace the "according to good engineering practices" wording of the amateur regulations. They have widespread implications for amateurs and manufacturers alike.

The FCC's intention, according to a spokesman in the Chief Engineer's office, is to find a new way to crack down on illegal CB amplifiers. But, as the spokesman put it, "the net catches a bit more than we bargained for, "including several popular ham transceivers. (That's based on published specifications, not any actual testing at the FCC lab.)

The regulation covers marketing and advertising of equipment as well, and, as our source put it, "if the gear is advertised you can assume it will meet the specifications." Specifics were hard to come by at deadline, but one thing is sure — amateur stations, upon inspection, will be checked at the antenna output, thus including antenna tuners, low pass filters, and so on. It is the whole operation the Commission will be concerned about, not the individual pieces of gear. A quality low pass filter then, should put most stations in compliance at HF.

The manufacturer's reaction was about as you'd expect. One importer suggested he would no longer be able to advertise or sell gear to dealers; another warned that he'd probably go bankrupt, if forced to take back gear that wouldn't comply from dealers who couldn't sell it. ARMA President Dennis Had of Dentron Radio visited Washington with a message from the manufacturers — "We applaud the proposal because at long last we will have a concrete definition of what good engineering practices means . . . but we feel the FCC has committed a grave oversight in not grandfathering some of the equipment affected by this regulation."

Had told *73* ARMA was asking for a grandfather clause on transmitters and transceivers (not linear amplifiers) built by legitimate manufacturers, who'd be forced into bankruptcy if forced to take back dealer's inventories. ARMA also asked for grandfather clauses covering used gear that would be deemed non-salable by the new regulation. Had argued that the grandfather compromise would lessen the injustices brought by pseudohams operating illegally with amateur equipment, and strengthen the bond between amateurs, the FCC, and the manufacturers. A decision was expected prior to the April 15th effective date.

A Federal Court judge has ruled that 5 dirty words should not have been banned from the airwaves by FCC regulations. And, no, as Morton Dean reported on CBS News, "We are not going to" (list them here).

As expected, *QST*'s ad rates will jump over 40% with the July edition of the League publication. That puts one full page of advertising in *QST* at $1300 (one time), instead of the old rate of $912.

Contesting may never be the same again! In early April, at a meeting attended by 80 contestors, Murphey's Marauders and the North East Contest Club merged by majority vote, thus ending a dynasty that lasted decades. The new club, named the Yankee Clipper Contest Club, unifies the northeast, and is expected to challenge west coast and mid-Atlantic clubs for national leadership through aggregate scores in Field Day Sweepstakes, ARRL DX, and CQ WW.

Here's an update on our "Briefs" report last month on the stolen repeater in Minneapolis/St. Paul MN. The 16/76 repeater there was vandalized and QRTed March 2nd, with several hard-to-replace items stolen. A temporary repeater was on the air within 24 hours, with a new installation scheduled to go on the air April 10th. Meanwhile, the club's rental agent has agreed to provide a safer location for the machine, including a security officer. Donations made the new installation possible, according to *The FM Scanner*, monthly bulletin of the Twin City FM Club, Brooklyn Center MN.

Neil "Rusty" Rapp WB9VPG, the world's youngest licensed amateur, has probably passed his Technican exam by now. According to Rusty's mom, the General CW may be a bit too quick for him to write down, so the General will have to wait. Mrs. Rapp herself has probably passed her Novice by now, while Rusty's dad is, by now, a General. As for the theory, six-year-old Rusty is plugging along, according to Mrs. Rapp, who says she doesn't see how he can pass . . . but she says she didn't think he'd pass the Novice either. Rusty has been getting plenty of CW practice with his new birthday present — a TS-520 transceiver from Kenwood.

As the WARC is coming up in 1979 to discuss frequency allocations, it is worth reading the report on the 1937 Frequency Allocation Conference in Cairo, Egypt. "The amateur interests were represented by the IRAU delegates, led by the ARRL's Mr. Warner. The three month long conference was not too good for the European amateurs. The reason was that most delegates of the European countries did not sympathize with the amateur movement. There were delegates who were expressly hostile to the amateur cause. Mr. Warner included the names of these delegates in his report. There have been some delegates who supported amateur aims, first of all, the USA delegation. The result was that all amateur bands were left intact for the Americas, while the Europeans lost large parts of the 80 meter band, and most of the 7 MHz band to be occupied by broadcast stations. The 5 meter band was completely taken away" (*Shortwave Review*, June/July, 1938, Budapest, Hungary). With thanks to W1PL.

A good WARC dialog between Japanese and Australian amateurs was reported at the JARL (Japan Amateur Radio League) 50th anniversary celebration last year. At a commemorative dinner party held in Tokyo Michael Owen VK3KI, an immediate past president of the Australian Wireless Institute, urged the Japanese to look ahead to the next 50 years of amateur radio. "In 1979 in Geneva, the representatives of all the countries of the world will meet and review the bands allocated to each service. There are two very important things that we should remember. The first is that each country has only one vote. Japan

has one vote. Australia has one vote. But so also has Tonga and Nauru." (Both are small Pacific Island countries of 78,000 and 5,000 populations, respectively — Ed.) "The second thing that we should remember is that there are over 300,000 amateurs in your country. The next largest amateur population in our region is in Australia, where there are only 6,000 licensed amateurs. Perhaps we should also remember that our region, which has 37 votes at the conference in 1979, extends from Iran to Tonga — half the globe." Owen went on to assess the future: "Our future is not secure. The amateurs of the world are not the only people seeking to preserve and indeed expand their bands. We must justify our position. We face particular difficulties in our region — we must remember that there are some countries where there are few amateurs and other countries where, perhaps for security reasons, amateur radio is not permitted. Indeed, in some countries it is treated with the greatest suspicion." Further on in his address Owen proposes a way amateurs in the Japanese/Australian corridor can argue amateur radio's case for the future. "The amateur service is global; the needs of amateurs cannot be judged by any country looking only at the narrow confines of

Neil "Rusty" Rapp WB9VPG, current record holder as the youngest licensed amateur, and working hard on his General at age 6.

that country. The unique contribution of the amateur service to international goodwill, training, and education is at the heart of its contribution to both the national and international interest ... The amateurs of the world must speak with one voice." Reprinted from *Amateur Radio*, Journal of the Wireless Institute of Australia.

On March 1st, the FCC extended permission for amateur ATV transmissions (fast scan) in the 420-540 MHz band. This was to allow for further experimentation unless changed by bandwidth docket 20777. Bruce Brown, operator of WR4AAG, the Washington DC ATV machine, gets much of the credit for the FCC action, which grew directly from his comments in response to 20777. Thanks to the *RF Carrier*, bulletin of the Dayton (OH) Amateur Radio Association.

ATV is on the air in California, according to *ATV Magazine*. The site is just north of San Francisco at Auburn, with coverage from San Francisco to Sacramento. The frequencies are 437.25 MHz in and 427.25 MHz out. Meanwhile, in Los Angeles the locals are reportedly building a 434 MHz in, 1240 MHz out ATV machine. Back east, Ed Piller W2KPQ, the Long Island Mobile Amateur Radio Club (LIMARC) ATV chairman, reports he's still working out the bugs on the club's ATV machine. Operating frequencies on LI are 439.25 MHz in, and 427.25 out.

The Personal Communications Foundation, a legal aid clearinghouse set up to advise attorneys representing amateurs in tower cases and RFI/TVI disputes, has received some substantial contributions. Yaesu and Wilson both donated $10,000 to go with $5000 from the ARRL, as reported here previously. PCF is still seeking legal briefs from lawyers involved in communications cases. PCF's address is 915 W. Lancaster Blvd., Lancaster CA 93534.

AMSAT has arranged Bank Americard and Master Charge for contributions and membership dues. Be ready with the information embossed on your charge cards when calling AMSAT at 202-488-8649.

In other AMSAT news, the battery situation on OSCAR 6 was status quo as of deadline. Three cells are apparently dead (of the 18 aboard), and telecommand stations have been instructed to turn the satellite off after each orbit for recharging purposes. Both current satellites will be coming out of 100% sunlight now, forcing some changes in operating schedules. Work on A-O-D continues in Washington, now with the help of two ARRL staffers dispatched to AMSAT headquarters through the League's agreement reported in our last two issues.

AMSAT sources say that A-O-D is progressing on a tight schedule, with the launch date now on a call-up basis. At the earliest, that puts the launch at the end of the year, or early next year. Lloyd's of London is underwriting the launch (a stipulation of the AMSAT-ARRL agreement) for $50,000, in case the launch fails or a suitable orbit is not obtained. A similar arrangement was set up for OSCAR 7, according to AMSAT.

Finally, AMSAT headquarters says there are still some 1st day covers available from the OSCAR 7 launch. They go for $1 each or six for $5, by writing (or calling) AMSAT in Washington at PO Box 27, 20044.

The extra effort separates the "serious" from the "enthusiastic." Here, the Dallas Amateur Radio Club effort illustrates the easy way to clamp a tribander onto a crankup tower. Thanks to the DARC.

An interesting note from England, via *Radio Communication*, Journal of the Radio Society of Great Britain, February 1977:

The severe interference emanating from the Soviet Union continues to cause problems to many services from time to time. It is reported that some European administrations have received the following message from Moscow: "Radio installations operated in HF bands are being experimented with in the Soviet Union and these experiments could possibly cause interference of short duration to your radio facilities. We are now taking actions in order to decrease eventual interference. Your reports will be attentively studied by Ministry of Posts and Telecommunications of the USSR. Regards. Minsviaz."

On a number of occasions, items of news from *Radio Communication* have appeared in the Soviet publication *Radio*. They have included extracts of information on RSGB affairs which have been distorted to place an unfavourable light on western society, and it is hoped that criticism by that same society of the present illegal activity by the Soviet Union on international frequency allocations will also receive due publicity in the same place.

How do you handle the many unsavory and questionable conversations and activities occurring on the amateur bands; The FCC says *ignore it*! Don't try to contact the people to reason or quarrel with them. Don't try to jam them. If they break into a net, and won't move, wait them out. But — do a lot of listening. Get specific information on calls, dates and times. Write down exactly what you hear. *Don't* send tapes to the FCC or make phone calls. Write down all the pertinent information and then mail it. The staff has limited time for these problems, but they are willing to pursue a good hot lead if it is well documented with enough background information. Reprinted from *The Printed Circuit*, Great Lakes Repeater Association, Detroit MI.

Another Federal Court decision, prompted by broadcasters, will affect ham radio. A US Court of Appeals panel, in throwing out some of the FCC's cable TV rules, severely criticized the Commission's rule making practices. As a result, FCC attorneys are warning Commission spokesman in decision making positions not to accept informal (verbal) comment on pending rule making proposals. It could affect "bull sessions" at hamfests and conventions, but the full impact was unclear at deadline. An earlier case brought by broadcasters resulted in the suspension of all license fees, and a Mexican standoff of sorts, as the Congress blames the Commission, and the Commission blames the Congress for the fees dispute.

As we were putting this edition of "Briefs" to bed, the word in club bulletins from one end of the country to the other was Field Day. It looks like another record-breaking year for participation, if the bulletins are portraying an accurate picture. One point to remember is that the ARRL has made the CW rule a permanent fixture of Field Day ... that is, CW contacts count twice a phone contact, so get those keyers and bugs ready!

According to the *West Coast DX Bulletin*, the Southeast DX Club (Atlanta) ran a poll of their membership on the needed ones. The following is the head of the list, notable for the listing of most of the usual "desperately needed" ones.

1. Iraq
2. China-BY
3. Clipperton
4. Khmer-Cambodia
5. Bouvet
6. Heard
7. Saudi/Iraq Neutral
8. Burma
9. D6-Comoroes
10. South Sandwich
11. Albania
12. Spratly
13. Okino Torishima
14. Kamaran
15. Bhutan
16. Laccadives
17. Bangladesh
18. Cocos-Keeling
19. Annobon
20. Geyser
21. Andamans
22. Qatar
23. Central African-TL
24. Chad
25. ZS2-Prince Ed and Marion
26. Auckland/Campbell
27. Malpelo
28. Aldabra
29. Willis
30. Mellis

Clubs across the country continue their search for new ways to relate ham radio to their communities. The Central Michigan ARC has an interesting PR-Public Service approach — a remote base setup for emergency weather alerts aimed at the general public. According to the CMARC bulletin (*The Scope*), police, fire departments, schools, and hospitals monitor

the 147.10 MHz warning frequency 24 hours a day. Hundreds of homes are linked to the system as well, since local supply shops are stocking scanner crystals. The remote base is controlled through the club repeater system, with a link to the Lansing Weather Bureau. The 147.10 MHz warning frequency is repeated through the Lansing system on a priority basis — any station on either repeater is overridden by the warning broadcasts. As John Hackman WB8QPE put it in a recent *Scope* article, "Emergencies come up quickly and without two weeks advance notice . . . ops who get the word off the air are those who help, not those who have to be reached by telephone . . ."

Two members of the North Shore Repeater Association (MA), operating on 28/88, March 4, at 11:35 pm, joined in a successful effort to prevent a tragedy, when Ed WA1LRL/M came upon a disabled car on the Cabot St., Beverly, railroad crossing, with an approaching train coming down the track.

Dick W1FAW phoned the Boston & Maine tower in an attempt to have the train stopped, but it had advanced too far down the track.

On being notified of this fact, WA1LRL grabbed several red flares he had with him and placed them on the track, stopping the train in time.

Then he and the train conductor pushed the car off the crossing, and in doing so discovered two youths who were quite ill lying across the tracks. They were assisted to safety. Reprinted from *QRA News*, bulletin of the Quannapowitt Radio Association, Lynnfield MA.

Contrary to some recent rumors and quite possibly to the hopes of those few who would like to see amateur radio's reputation for self-discipline destroyed, the second 1977 meeting of the Ohio Area Repeater Council was neither a flying circus nor a dogfight. The Council met at the Delaware County Historical Society in Delaware, Ohio, on Saturday, April 2, with representatives of 44 of its 82 supporting member repeaters in attendance (plus 16 guests).

The committee assigned to examine the use of the lower portion of the two meter band by Ohio amateurs reported that most of those SSB operators whose licenses permit operation below 145 MHz use frequencies below 144.5, and the Technician Class licensees now operating just above 145 MHz would move down if given an opportunity. Having already voiced its opposition to unrestricted repeater operation in all parts of the amateur bands, the Council voted to support the Iowa proposal to establish a new repeater band between 144.5 and 145.5 MHz and to authorize Technicians' use of 144 MHz.

Conflicting claims to priority on the 146.34/94 repeater pair in northwestern Ohio and southeastern Michigan by WR8ACT in Toledo, Ohio, and WR8AJV in Belleville, Michigan, were reviewed. The Toledo repeater was originally established in 1969; the Belleville repeater was sanctioned by the Michigan Area Repeater Council at a time when it appeared that Toledo had relinquished the frequency pair. After examining available records and hearing statements by both parties, the Council members concluded that Toledo had a legitimate claim to the frequency, and reaffirmed its earlier coordination of WR8ACT without a dissenting vote.

A strong plea was made to all present to write their senators and congressmen, urging them to support S-864, Senator Goldwater's bill that would require manufacturers of household electronic equipment to install adequate RFI protection. Thanks to W8GRG.

The Illinois Repeater Council took action at the February meeting on the issue of 15 kHz repeaters — and whether they should be "right side up" or "upside down." Illinois voted to adopt the so-called "California plan" which follows the "reverse" principle. This is the same plan followed by western Pennsylvania, Ohio and Indiana (and Michigan is reported to be studying such plan). Reprinted from the Lake Erie ARA *Repeater Newsletter*, Lakewood OH.

Malaysia has apparently acquired its first 2m repeater. Via *Amateur Radio*, the official journal of the Wireless Institute of Australia, comes the news that a frequency coordination committee has approved 147.90 MHz output and 147.30 MHz input for the system. It's to be located at Ulu Kali, with maximum power of 50 W. *Amateur Radio* also reports that Malaysian amateurs are now authorized to use RTTY.

With A-O-D in the offing, AMSAT is anxious to help club groups interested in demonstrating the satellites. A-O-D, which will become OSCAR 8 after launch (and is to be controlled by the ARRL), will be set aside primarily for educational purposes, due to its low orbit and short acquisition time. Contact AMSAT for more details.

The winner of the 1976 Amateur Radio Biting Bug Award is Anthony R. Curtis K3RXK of State College PA. The award, given to the writer of the best amateur radio article published in a US non-ham publication, is a $50 prize and plaque.

Mr. Curtis' article in the February, 1976, issue of *Popular Mechanics* was judged the best of over 50 submitted in the competition. Entitled "New Satellites Make Ham Listening More Fun," the article was accurate, well-written, and attracted a large non-ham audience to amateur radio. Mr. Curtis is an assistant professor of journalism at Pennsylvania State University.

There will be no 1977 competition for the Amateur Radio Biting Bug Award. However, competition will resume in 1978 in two categories. A plaque and a $200 prize will be awarded to the writer of the best article about amateur radio in an American nationally-circulated non-ham publication during 1978. To the writer of the best ham article published in a regional or local publication, there is a plaque and $100. Articles will be judged on how well they attract non-hams to ham radio. Writers do not have to be amateur radio operators.

The judge is Ray Collins, a professional writer and ham operator. Judging will be based on an article's subject matter, style, accuracy, accompanying illustrations, and the mention of where a reader may obtain more information about the hobby.

Photostats of articles with the name and date of the publication should be sent to Ray Collins WA2GBC, Harter Road, Morristown NJ 07960. Please enclose a self-addressed stamped envelope. All entries must be submitted by Jan. 31, 1979.

Kansas State Police officials have decided to do away with the traditional "10" code, in favor of simple words and phrases. "10-4" is now "okay," and "10-13" is "help, policeman in trouble." Officials report that the changeover is going smoothly, although some officers still forget and use the "10" code from habit. Reported by the AP.

FCC licensing figures released by the ARRL indicate a total of 293,655 amateurs in the states. The breakdown, as of the end of January, was: Novices — 38,365; Technicians — 61,359; Conditional — 22,483; Advanced — 71,360; and Extra — 15,732. Whether we can break 300,000 by the end of the year remains to be seen, but if current application rates continue, the chances seem good.

L.A. area repeater owners and users alike are angered by the content of RM 2844 submitted by Jones P. Talley W5JTE, which requests that the FCC place a blanket ban on closed repeaters. The majority of those opposed feel that Mr. Talley's pro-

At the March meeting of the United Radio Clubs in San Pedro CA, Dr. Norm Chalfin K6PGX spoke on AMSAT/OSCAR programs past and future. Here, as the group listens to OSCAR 7 mode B, he points out where the spacecraft is at the time. Thanks to K6SWD for the photo.

posal is an infringement upon their right to own and use personal property as they see fit and fear that once all repeaters are made open and available to any amateur, the next logical step would be to make all amateur stations legally available to all amateurs at all times. This they cite as a direct violation of the Constitution and have vowed to defeat the RM. Other reasons cited include the concept of this ban creating a non-commercial Radio Common Carrier service within the amateur bands, and the fact that FCC personnel have flatly stated that no amateur is obligated to provide any service to another ham.

In Minneapolis MN, the Handi-Ham System has installed a new device called the code line. By dialing 612-521-3925, anyone can receive code practice at several speeds, theory problems, and amateur bulletins. The service is available 24 hours a day, 7 days a week, with each recording lasting between 20 and 30 minutes. On Sundays, the equipment is put into the record mode to pick up comments, criticisms, and suggestions. A grant from IBM financed the code line, and a fundraising drive is planned to finance a WATTS line. Other plans call for putting the system on the air one or two times a day through the phone patch facilities at club station WAØQWE. Thanks to the *5 X 9 Newsletter*, Worthington ARC, Worthington MN.

The FCC has inadvertently issued a number of callsigns beginning with the prefix WCØ in the Ø call area. The WCØ callsign block is authorized for RACES stations only. Amateurs who receive such calls may use them until they receive new calls mailed automatically by FCC. However, they are advised not to order QSLs with the WCØ call, as it will not be their permanent callsign. From the ARRL *Bulletin*.

One hundred years ago this year the first Japanese settlers came to Canada. And in honor of that event a small number of amateurs will be signing special callsigns in conjunction with cultural events across Canada. Two have been heard thus far, CJ3BLU and CJ3DR. Special QSL cards are being designed, and special certificates will also be available. Three CJ contacts will be required to qualify. According to *The Ontario Amateur*, Journal of the Radio Society of Ontario, only 25 CJ stations are expected to be active during the 1977 celebration.

Stolen radio recovery is beginning to become routine around Chicago, and this time it went right "by the book" – with less than 24 hours between theft and recovery! Here are the details of this textbook case:

Monday evening, Feb. 28th, WB9NGW's Cobra-200 220 MHz radio disappears from his car in Oak Park. Later that evening, the "Main Squeeze" calls "breaker four" on the CFMC 220 repeater. Gary WA9NSO responds with appropriate "handle" and language, but after a few minutes of conversation, "Main Squeeze" disappears. Gary, Ron WA9LAY, John WB9FCB and Angelo WB9RWL wait some time for his return, but no further signals are heard, and they assume they have lost him.

Not so, for the next morning the quiet repeater comes alive again with "breaker four." Gary again responds, and learns that "Main Squeeze" had blown a fuse the night before. His CB power supply couldn't quite handle the 20 Watt input radio. Fuse replaced, he is now able to enjoy the peace and quiet of the new FM-CB rig, as it is described by Gary. Gary then pretends to be interested in "Squeeze's" Cobra-200, and asks if he can come take a look at it, since Gary "only has a 2 channel, one Watt job" and wants to get a better radio.

Suspecting nothing, "Squeeze" gives Gary an address in Oak Park. Fortunately, Gary is nearby, and drives right over to take a look at the rig. John and "Squeak" are standing by on the 450 repeater in case any assistance is needed.

Gary arrives at the specified location and is met by Dan WB9JFO, who has been listening and who lives nearby. Moments later, "Main Squeeze", a 16-year old boy, comes out to the car with the radio. Inside Gary's car, Tony ("Main Squeeze") is fascinated by Gary's mobile installation, which had been previously described as SSB-CB and business band equipment, while Gary and Dan open the stolen radio's cover and find WB9NGW's driver's license number engraved on the frame.

At this point, Gary calls the Oak Park police on the CFMC 220 autopatch and asks for a squad car to meet him and receive the radio. Meanwhile, Doug WB9TWW, who has also been listening, calls Jim WB9NGW on the phone, and informs him that his radio has probably been recovered. All parties meet at the Oak Park Police Station, where Jim identifies the radio, and police detectives question Tony about the acquisition details of the radio.

Tony had originally said that he had bought the Cobra from an "acquaintance" at school, but later admitted to police that he had taken part in the robbery, acting as lookout. Oak Park Police informed the *Squelch Tale* that the case was on the way to Juvenile Court. Reprinted from *Squelch Tale*, Bulletin of the Chicago FM Club, Chicago IL.

Al Glasser K6RFU, conducting the Bellflower Symphony Orchestra in one of his own compositions. He appeared at the invitation of the regular director, Geza Szabo, holder of HA5KBC. Thanks to W6NAZ.

Martti Laine OH2BH, via the West Coast DX Bulletin, *filed the following report on the short stop at Bouvet Island by the Norwegian Antarctic group. Bouvet is a small island about 800 miles from the Antarctic circle, in the Norwegian sector. It is not what one would call an ideal DXpedition vacation spot! – Ed.*

I just spoke with John LA1VC, who was with LA3CC aboard the Norwegian ten week END-Antarctica survey starting from South America, coming all the way back to Bouvet and up to Capetown. John, who is an electronic engineer at Norwegian Posts and Telecommunications, was responsible for all the electronic equipment and radio communications during the expedition. He knew exactly the demand for Bouvet and just for that reason took the Atlas transceiver and the other necessary gear to operate from Bouvet if possible. As noted earlier, the reason to stop at Bouvet was only to leave the radio beacon on the island and then continue on to Capetown. No extra effort was planned in case of poor weather . . . they would just continue on. The schedule was to be in the vicinity of Bouvet around February 24th or 25th, and this was reported when they were in Antarctica. They were early arriving at the island and were there on Feb. 23rd, landing during the afternoon on the northwest part of the island at a place called "Westwind Beach." The landing was done with a small, rubber landing raft. Some ten people were taken ashore and the work of the beacon installation started. When the beacon work was almost completed, the Atlas and a 14 MHz dipole was fixed to open the operating from Bouvet. However, the weather was getting worse and the group was ordered to return to the ship immediately. This had to be done as there was no helicopter aboard the ship and there was no way to remain on the island after darkness (which was about 1900Z). The second day at Bouvet, February 24th, the weather was not as good as the previous day, and they were only able to land on the southeast part of the island, at a place called "Blacksand Beach." This is the other of the two possible landing sites on the island. The landing was made about 1300Z with plans for about a five hour stay. The station was again set up at about 1500Z but there was no propagation on twenty meters. The first contact was made at 1545Z with ZS5WT in South Africa, this being followed by JR6RRD on Okinawa. Calling "CQ CQ" for many times, the first and only US contact was coming up . . . W6ID in San Diego at 1609Z. There were no more deserving sixes about and subsequent CQs went all for nothing. At 1630Z the band opened to Europe and 26 QSOs were made. OH2BGD was the last to make it through with his 14AVQ, and he still cannot believe that he made it. After 29 QSOs, the order was received from the ship to return immediately. This was at 1740Z (about one hour before local sunset). The plan was to do one more landing on February 25th but this was not possible due to the weather. The ship left Bouvet about 1600Z, heading for Capetown. All in all, they say the weather was exceptionally good during the three days they were at Bouvet, better than they had hoped for. That was Bouvet-1977 under the very difficult conditions. The overriding concern was to be responsible for the safety of the people on the island and any risks had to be kept at a low level. Amateurs generally should express some thanks to John LA1VC/3Y1VC for his efforts and a job well done. It was his effort which got the Atlas and the storage battery on, despite the limited capacity of the rubber boat. And most will understand the need to be off the island when log sheets are starting to get wet. Two years from now there will be another Norwegian survey, this just being announced. They are planning to have a helicopter aboard, to build up the base on Bouvet and to spend some time on he island. John is

hoping to again be along and to make all the DXers happy.

On Saturday, April 2, the southern California Repeater Association elected Bill Pasternak WA6ITF, *73*'s West Coast Associate, to the position of Vice Chairman for the 1977-1978 term. Elected along with Bill were Jim Hendershot VA6VQP as Chairman, incumbent Don Root WA6HJW as Secretary, and *73* writer Warren Andreasen WA6JMM as Treasurer. Jim, Bill, and Warren ran unopposed.

Highlights of the meeting included the announcement that SCRA would appoint "Area Advisors" selected by recommendation of the amateurs of each specific geographic administration area to help those amateurs involved in new systems to interface on an interference-free basis with existing co-channel and adjacent channel systems. The concept, pioneered by Bill, is to establish direct lines of communication between existing entities, new systems, and the SCRA so as to avoid "brush fire" repeater confrontations that have been the case in the past. On high recommendation of those present, Paul McClure WA6HGK has already been selected to act as the San Diego area interface.

For full details, read Bill's "Looking West."

Mrs. Cecile J. Gibbs retired May 31st after serving thirty-two years with the Federal Communications Commission. Mrs. Gibbs, better known by amateurs, commercial communications companies, and shipping interests, as "Granny Gibbs," is held in the highest esteem for her genial manner and unfailing assistance to the public. During Mrs. Gibbs' thirty-two years of service, she has served with the following engineers-in-charge: L. I. McCabe, J. H. McKinney, E. H. Marshall, C. R. Williams, and, presently, Danial A. Cantrell. On behalf of amateurs everywhere, we at *73* wish "Granny Gibbs" all the best.

A postscript to our report last month about the tragic death of Her Majesty Queen Alia of Jordan JY1XYL. The Queen was not the only amateur to die in the helicopter crash near Amman in early February. Lt. Col. Bader Zaza JY3BZ, the pilot of the craft, also lost his life. Zaza was King Hussein's aide-de-camp, and met personally with many amateurs around the world while accompanying the King on trips abroad. He was instrumental in setting up the Jordanian amateur radio awards programs, including the Arabian Knights, Silver and Coral awards. Thanks to JY9BB.

Boston area clubs scored big in the ham PR department with a two weekend exhibition at the Boston Museum of Science. Two TV segments on local news programs, plus good publicity in Boston area newspapers, highlighted the effort, with hundreds of QSOs logged on all bands. Another effort is already being considered for next year, according to Boston amateurs.

Computers will soon be a part of your radio operation whether you desire them to be or not. Look for the omnipresent microprocessor to soon appear in your SSB transmitter and receiver. RTTY operators are already making great use of them in text editing and code conversion applications. They also do a very nice job of deciphering the good ol' Morse code. But as new as they may appear to us, the miniature computers of today have been foretold by the great minds of the past, even if they had failed to actually implement the silicon hardware that is now in use. In evidence of this fact, please peruse the text below.

Thy gift, thy tables, are within my brain
Full characterized with lasting memory,
Which shall above that idle rank remain
Beyond all date, even to eternity;
Or, at least, so long as brain and heart
Have the faculty by nature to subsist,
Till each to rased oblivion yield his part
Of thee, thy record can never be missed.
That poor retention could not so much hold,
Nor need I tallies thy dear love to score;
Therefore to give them from me was I bold,
To trust those tables that receive thee more.
To keep an adjunct to remember thee
Were to import forgetfulness in me.
William Shakespeare

Thanks to *PAARA Graphs*, bulletin of the Palo Alto ARA, CA.

"Understanding FCC Regulatory Methods" was the title given to an open format seminar held in Alhambra Park, Alhambra, California, on Sunday, April 3. Hosted by Alhambra RACES and sponsored by a combined effort of the Mt. Wilson Repeater Association and the new Amateur Radio Media Workshop, this meeting was held to acquaint area amateurs with the many dockets now under consideration by the FCC regarding amateur radio deregulation and reregulation and to explain the proper methods to use in filing responses.

Chairman for the event was Bob Thornberg WB6JPI, licensee of WR6AMD and immediate past chairman of the SCRA. Along with Bob, a panel of experts including Herbert (Pete) Hoover III W6ZH, Bill Pasternak WA6IFT, Lenore Jensen W6NAZ, Al Ogden W6SPK, and Donald Root WA6HJW were on hand to help address specific points and answer questions from the audience. Virtually all pending matters were covered in this 4 hour seminar, with special emphasis given to NPRM #s 21116 and 21117. About 100 area amateurs attended, and though turnout was light, the meeting was deemed a total success by those attending. See "Looking West" for more details.

It is fortunate that most of us don't have the use of a "cherry picker," or we would be likely to attempt the same foolhardy trick WA3JSU is shown doing on page 17 of the March *QST*. His footing atop the basket, which pivots easily, can only be shaky at best. As an ARRL (life) member, I must register a protest against the outrageous disregard for both common sense and OSHA safety rules depicted here. I would not want any of my funds used to pay off a lawsuit resulting from the ultimate end such foolhardiness could lead to. Where was Mr. Bloom's supervisor? Thanks to WØOQM, via *Boulder QSP*, the bulletin of the Rocky Mountain VHF Society, Boulder Co.

The DXCC mess in Newington should be nearly clear by the time you read this. The ARRL announced in mid-March the appointment of Donald Search W3AZD as assistant communications manager in the DXCC branch. To quote the *West Coast DX Bulletin*, "... sounds like pure Newingtonese saying he is taking over the DXCC desk ... they are working hard to clean things up for his arrival ..."

Some interesting projections on RFI complaints, via the *West Coast DX Bulletin*: Back in 1973, RFI complaints to the FCC were doing a monthly bounce that would put the annual figure at around forty to fifty thousand a year. Now it is over 100,000 a year, that was last year, and by the end of fiscal 1978 there are expected to be over 200,000 complaints a year. Congressional inquiries are following somewhat the same pattern, going from less than 500 annually in fiscal 1973 to an expected 30,000 in fiscal 1978. Some have said that the only way some meaningful RFI legislation will pass the Congress is through consumer action — reason enough to get *your* comments to your congressmen and senators, on the Goldwater RFI bill, S-864.

WARC fallout continues, with the North Jersey DX Association petitioning the FCC for expansion of the 20 and 40m phone bands. On 40m, NJDXA would like 7075-7100 kHz, and to have the 20m phone band expanded down to 14150 kHz. The FCC has assigned the proposal number RM 2828.

From the calls issued to some female amateurs, the "Candy Company" may be male chauvinistic to prove the point — Alecia WB9LAD, Susanne WB6BRA, and one more — Doris WA3HEN. Thanks to W6GSR.

With thanks to the Palo Alto CA ARA bulletin *PAARA Graphs*, we learn of some interesting experiments underway on 450 MHz ATV. VE3FZK is reportedly active on "pong" over the air, using the 2m band for sending the control signal for the second player's "paddle." *PAARA Graphs* adds that it may not be long before Star Trek wars are being fought by microprocessors on local RTTY repeaters.

The Foundation for Amateur Radio (FAR) is offering four scholarships to licensed amateurs for the 1977-1978 academic year. Two scholarships are for $750.00 and the other two are for $250.00. If you are interested, write to FAR, 8101 Hampden Lane, Bethesda MD 20014. Thanks to *LERC Bulletin*, Burbank CA.

Via the *West Coast DX Bulletin* (with thanks to the Marin County DX Group), we learn that French stations have been authorized to operate on 160m. The new regulation allows only for contest operation of an international nature, and limits French amateurs to 10 Watts. They are also limited to operations on only *one* frequency — 1826 kHz. As the *DX Bulletin* put it, "now every weekend will be contest weekend ..."

UKØIAB will be operating on 144.050 CW and 144.300 SSB and AM daily from 1100 to 1200 GMT, looking for contacts with the states. He will be operating OSCAR, 2-10, during the same time period, when possible. UKØIAB is Igor, located in Magadan City, zone 19. He uses a 13 element 2 meter beam. Thanks to W6AQ.

AM is not dead! At least not on 6m and 2m. According to the *Middle 6 Net Newsletter* (Napton MO), 50.210 MHz has been chosen as a national calling frequency, with many AMers monitoring the frequency waiting for the band to open, and more joining all the time. The calling frequency originated with SMIRK (Six Meter International Radio Klub), which has been working hard to promote six meter activity. The national calling frequency for SSB stations is 50.110 MHz, with activity up to 50.200 MHz when the band opens.

BE MY GUEST

visiting views from around the globe

OM Winter-East

Since the birth of radio communication, amateurs have always been there to lend a helping hand wherever and whenever disaster struck. On the last weekend of January, 1977, a different kind of a disaster struck western New York State. For the first time in history, a disaster was officially declared due to excessive snow! At the first glance, it might almost seem funny, or that people have turned soft, to be so affected by the white stuff. However, when you consider that snow fell in one amount or another every single day for over a month preceding the storm, and that, for the country as a whole, this was the hardest, coldest winter in all recorded history, it begins to take on a different proportion.

Friday had dawned dismal, like a great many days before it. Temperatures ranged from slightly below zero to five or ten above. A light dusting of snow was added to the foot or so of powder already on the ground. The weather remained stable until just after lunch. Then the storm hit. In the next eight hours, over a foot and a half of snow fell. Winds rose to 40 mph or so, with gusts over 55, and the temperature plummeted.

Before and after digging out. This house, located near the author's home, was completely buried in snow. Snowmobiles ran over the roof, the chimney (at the right end of the house) was covered over, and rescuers had to tunnel down to the door in order to evacuate the family. (Photos courtesy Albion Advertiser, *used with permission.)*

In less than an hour, the New York State Thruway became impassable. The expressways in and around Rochester were closed by the police – too hazardous to attempt any kind of travel. Other highways in the region quickly became parking lots. These were the conditions in Rochester. Further west, they were worse. My home is in Albion, the hardest hit area east of Buffalo, which of course got the worst.

Between the two cities, Rochester and Buffalo, Lake Ontario curves so that a wide bulge extends north several miles further than the rest of the lake shore. Being just on the edge of the favored intercity route, and not conveniently handy to either city, the land is mostly farmland – flat, open, and completely at the mercy of the wind. It is called Orleans County, and Albion is in the middle.

It took me four hours of creeping past stalled cars, detouring around accidents, and clawing my way through snow drifts to reach Orleans County, and I thought I'd made it. Old Man Winter second-guessed me. Five miles east of Albion, a tiny village called Fancher can be found (if you don't blink on the way through). There the State College of Brockport NY maintains a rural property for ecological research and conferences. It was just a mile west of that property that I was told to turn back. Scores of autos were bogged down ahead of me, and there was simply no passage.

I turned down a side road toward the college property, hoping to work my way around this last obstacle, and there I bogged down in a large drift. It was half a mile from my car to the conference center, and I wouldn't have made it except that the caretaker of the property went with me. The storm was at its peak, with the temperature around ten below. With winds as high as they were, the windchill factor could freeze exposed flesh in a matter of seconds. We made it by walking backwards into the wind, and stopping in another building halfway there.

It would have been a pleasant place to be stranded, and I had good company – four cute young school teachers. Five miles away, however, trouble was starting to pile up. The XYL was stranded with a pair of stir-crazy four-year-old twins. The house is an old one (one of the oldest in Albion), and the brutal winds were forcing cold and snow in so violently that a pile of snow had gathered in a room which was separated from the outside by another room. The water in the bottom of our washer froze.

My hopes of getting out Saturday faded with the day. The snow had stopped, but not the wind. As fast as a pathway could be plowed on the roadway, powdery snow which had collected since Christmas had blown in to close it up again. Highway crews were fighting a losing battle.

. Throughout the county, every high school, every recreation hall or other suitable building became an emergency shelter for the hundreds of people stranded by the storm. The CD director had to coordinate his efforts through the sheriff's office, as the CD center was all but inaccessible in the storm. All over the region, amateur radio nets were being called into emergency session. At home, pipes were freezing and bursting. Barb was thinking of evacuating to the high school.

> **"With winds as high as they were, the windchill factor could freeze exposed flesh in a matter of seconds. . ."**

Sunday morning I said, "To hell with this!" and started walking. The snow had packed so hard you could walk over the drifts without sinking in. My car was buried up to the window. I later heard that after one car was removed from atop a snowdrift, another was found buried three feet beneath it, the driver inside frozen to death.

I was lucky. Less than a mile from the college property, a car picked me up. The driver felt two would have a better chance of making it through than one. We zipped through one of the temporary openings in a half-mile long drift, and I saw the top of a tractor-trailer sticking out. Occasional hints were visible of cars buried in the walls of the ravine of snow. On the other side was Albion and home.

To the towns east of Orleans County, the storm was over. Highway crews trying to clear the roads had their work grind to a screeching halt as sightseers came in from adjoining Monroe Country and found themselves stranded. The sheriff finally cracked down, ordered *all* roads closed, except for official emergency traffic, and imposed a thousand dollar fine on violators. I was home fighting with frozen water pipes by then.

In between plumbing and trying to seal up heat leaks, I turned on my rig. Of course, the two meter repeaters were going full blast with the emergency, but I only had my low band rig operational, and me the communications chairman for two Red Cross

chapters! I checked into the New York Public Operations Net on 75, and then notified the sheriff and the Red Cross that I was finally home and available.

The net manager, K2KQC, was stranded in Buffalo, far from her rig. W2PZL and WA2SYR were holding things together. Of course, there were plenty of others taking their shifts as net control, but these two stand out in my mind, especially WA2SYR. He's blind, but the best organized net control I've ever heard.

Fortunately, the telephones managed to hang together. Otherwise the already busy nets would have been bedlam. Throughout the day, however, I was asked to originate a few messages out of state for stranded motorists. I even managed to get some of the pipes fixed. Once again we had water running, and the wife felt better.

The CD headquarters for the entire western New York region is in Batavia, 20 miles south of Albion. There an especially energetic group was working through the 04/64 repeater. They were under the guidance of WA2AIV, who stayed several days at the center, and became the first person to sleep in the bunk room since the place had been built. Bad as things were in Orleans County, we had a picnic compared to Erie, Niagara, and Chautauqua counties, which had a lake upwind which manufactured an unreal amount of snow. In Buffalo, K2DWI and others activated the station that had been installed at Salvation Army Divisional Headquarters after the 1972 floods. But I didn't keep track of them. I had troubles of my own.

"The brutal winds were forcing cold and snow in so violently that a pile of snow had gathered in a room which was separated from the outside by another room. . ."

Sunday afternoon the Red Cross at Medina called. A young man was in critical condition in the hospital there. The telephones were log-jammed, and they were trying to reach his kin in Rochester. For the first time in 25 years of hamming, I listed emergency traffic. I wanted a phone patch to Red Cross Divisional Headquarters, but at that moment there was nobody aboard in Rochester. One of the guys cut up to two meters and W2QYT responded, getting me through to Jim Cross, the disaster coordinator. Within the hour, the family was on their way.

Roads were still closed Monday, and were destined to remain that way through Thursday. By Wednesday, most of the nets were deactivated to a standby condition. Maybe I shouldn't admit it, but in all my years as a ham, this was the first time I had figured directly in a genuine emergency situation. Even then my contributions had been minimal — a mere drop in the bucket. I wish I could list all the guys who worked shift after shift as net control, or served as internet liaison, those who passed reams of traffic, and those who stood by and waited, but were not needed. They also serve who stand and wait.

Six days after the storm had begun, Orleans County opened the roads. Buffalo didn't open for a week or more after that. Even though I got off as easy as I did, it is easy for me to understand the bewildered, almost unreal feeling folks out this way have over the whole affair. Most of them still don't quite know what hit them. When I drove to work Thursday, it felt like I was driving down a gully, and I felt a bit uneasy. It started snowing again Thursday afternoon, and everybody beat it home. We were all scared.

Once my car was dug out of the snow, the AAA paid the tow. Getting it going again was another matter. That cost over $160. This, plus the loss of three and a half days pay, made the storm a bit expensive, but I still think I got off easy — especially in comparison to Buffalo. I guess I was little more than a bystander, but you really never know just how you'll act until the thing happens, and then, just like everybody else, you muddle through the best you can. It's only a matter of how the cards fall that decides whether you'll play a key part, or just be another drop in the bucket. Just remember — it takes an awful lot of drops to put out a fire, but they all help out.

W. Edmund Hood W2FEZ
Albion NY

OM Winter-West

SERVCOMM, a short title for service communications, is a group of about 100 amateur radio operators who live along the eastern front range of the Rocky Mountains from Cheyenne, Wyoming, in the north, to Raton Pass on the border between Colorado and New Mexico in the south. Recently organized (and within the American Radio Relay League public service emergency communications function), SERVCOMM has aided a remote community during a serious fire, participated in various mountain terrain rescues and, more recently, fully aided in a regional search and rescue operation occasioned by the 10-12 March 1977 gale force blizzard that struck El Paso County, Colorado, with full fury.

Amateurs answered a call for help when authorities had trouble establishing communications vital to search and rescue operations. SERVCOMM responded and filled the gap.

Ninety-three rescues were made by El Paso County Search and Rescue teams in close cooperation with ground and air units based at nearby Fort Carson. Amateurs rode with the various ground and air units. Equipped with battery powered two meter handie-talkies, they relayed rescue mission information to and from units in the field to a base station (WAØHFJ) set up in a motor home and parked next to the El Paso County Sheriff's office. US Army, El Paso County Sheriff, and El Paso County Search and Rescue authorities sat side by side in the "Sheriff Central" command post and directed a successful operation that saved lives and greatly reduced suffering in the afflicted areas.

The Colorado Springs two meter repeaters carried most of the emergency traffic. Primary repaters 37/97 and 16/76 were backed up with the facilities of 19/79, 27/87, and 03/63 repeaters together with thirteen SERVCOMM RTTY stations who stood by in the event the situation mushroomed.

Four wheel drive vehicles were provided and operated by radio amateurs in neighborhood assistance missions. This action reduced the overall emergency problem. Among the 4 WD teams were: WA7HKS/Ø, WBØKDN, WAØLRK, WØMBZ, WBØMHP, WØMQE, WØNR, WØOQI, WBØPNX, KØROL, WBØSDW, WBØUIX, WBØWQI, and WØWYZ.

A local surgeon, WAØRGA, needed to be at an operation scheduled across the city. KØROL and WØWYX hooked up a 4 WD tandem and essentially tobogganed WAØRGA in his own 4 WD and got him to the scheduled operation in time. At the same hospital was WBØEFU, who had given birth to a fine daughter the day before. WBØEFU operated a battery powered TR-22 from her bedside and served as liaison between the SERVCOMM nets and the hospital. Various missions of transporting medical personnel to and from several facilities were completed.

WØOXR left work early as the storm rolled into the Colorado Springs area. Bound for Falcon, Colorado,

The raging blizzard penetrated everything. Those at home for days couldn't get to work.

Search and rescue operations continued after the storm, because scores of missing people, cars, and livestock had to be accounted for.

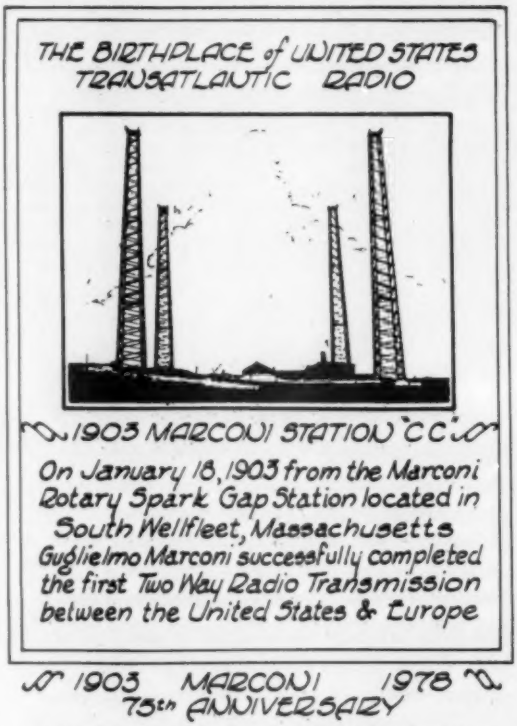
about twenty miles east of Colorado Springs, he could not see well enough to drive due to high winds and driving snow. Even the slowest speed as he groped along did not prevent him from bumping into yet another car stranded in the road. Some 35 hours later, WØOXR and eight others in stranded vehicles near him were rescued. They came through the ordeal without sleep or food by rationing fuel and maintaining two meter status reports. During the long night hours they signaled to each other with interior car lights, as head lights and tail lights were buried in snow and car doors were frozen shut. Rescuers, guided by SERVCOMM, had to battle long stretches of 15 to 20 foot snow drifts in almost zero visibility to reach them. This rescue was typical of the overall operation that employed five US Army half tracks, each carrying an amateur radio operator equipped with two meter equipment. During the last phase of the operation, when sector sweeps were made with various ground and air units, SERVCOMM continued the emergency communications service. Almost all of the emergency communications activity was captured on tape for historical record.

During ensuing days, two debriefing meetings were held with representatives of the El Paso County Sheriff's Office, Colorado State Highway Patrol, El Paso County Search and Rescue Group, US Army, and SERVCOMM present. The meetings produced 27 suggestions for improvements in the SERVCOMM operational plan so that the next time SERVCOMM is called upon, it may be in a better position to serve.

Behind all of SERVCOMM's emergency capability and potential to serve is the farsighted dedication and expertise of the Pikes Peak FM Repeater Association that has for a decade built, sited, and maintained two meter repeaters at altitudes that often provide severe lightning and arctic environments for equipment and those who voluntarily maintain them. Without this group, the loss of human life and suffering would have been much higher. Doing this, of course, is what each amateur everywhere knows to be a good measure of what amateur radio is all about!

D.A. Bartol WØPT
Colorado Springs CO

75 Years


THE BIRTHPLACE of UNITED STATES TRANSATLANTIC RADIO
1903 MARCONI STATION "CC"
On January 18, 1903 from the Marconi Rotary Spark Gap Station located in South Wellfleet, Massachusetts Guglielmo Marconi successfully completed the first Two Way Radio Transmission between the United States & Europe
1903 MARCONI 1978
75th ANNIVERSARY

Guglielmo Marconi came to Cape Cod, Massachusetts, in 1901 to establish the first transatlantic wireless station in the United States. The station was constructed on the sand dunes of South Wellfleet and was completed in late 1902. The transmitter was of about 30,000 Watts power, consisting of a three foot diameter spark gap rotor supplied with 25,000 volts from a kerosene generator. The aerial wires were to be supported by 200 foot masts. The masts, 20 in number, were placed in a circle 200 feet in diameter in the sand dunes. The Cape Codders were skeptical of the masts being erected in the sand dunes, and as they predicted, the masts were blown down in a northeast storm in November, 1901. Marconi then erected four 200 foot timbered towers and in late 1902 the station went on the air for tests.

On the night of January 18, 1903, Marconi attempted to send the following transatlantic wireless message from the then President Theodore Roosevelt to the King of England, Edward VII: "His Majesty, Edward VII, in taking advantage of the wonderful triumph of scientific research and ingenuity which has been achieved in perfecting a system of wireless telegraphy, I extend on behalf of the American people most cordial greetings and good wishes to you and to all the people of the British Empire. Theodore Roosevelt."

The message was received at the Marconi station in Poldu, England, and for the first time the United States had been linked with England by wireless. A return answer was received at South Wellfleet from King Edward VII and was delivered to the President through the South Wellfleet Railroad Telegraph station.

In 1907, the engineers realized that they had built the station too near the ocean, and by 1917 the sand dunes had eroded close to the tower bases. The station had to be abandoned soon thereafter. Today approximately one half of the site has been claimed by the Atlantic Ocean. In its 15 year history of operation, the station had three callsigns: CC, MCC, and WCC. Old "CC" was a prime press outlet to ships at sea and to this day WCC, now located in Chatham, Massachusetts, is the busiest commercial radio station on the east coast. The station handles worldwide traffic to and from ships at sea, and is still communicating by international Morse code as used by Marconi in his day.

During the week of January 14-22, 1978, the Town of Barnstable Radio Club will celebrate the 75th anniversary of Marconi's first two-way transatlantic radio transmission. The club will recreate this event with a multitransmitter amateur radio station operating from the original location in the Cape Cod National Seashore Park in South Wellfleet, Massachusetts. The station has received a special event callsign, "KM1CC", from the Federal Communications Commission, and will be manned by members of the Barnstable Radio Club. "KM1CC" will be capable of worldwide communications. The station will be open to the public and we hope you will come to visit us.

Frank Caswell W1ALT
Brewster MA

Jack Anderson–Nuts!

"The story charged that CBers haven't gotten a fair shake at the FCC because CB radio has traditionally been regulated by hams. . ."

The headline, from coast to coast, read: "Radio Hams Are Favored Over the CBers." National columnist Jack Anderson had scored with another hot story, and ham radio was clearly the loser.

The story charged that CBers haven't gotten a fair shake at the FCC because "CB radio has traditionally been regulated by hams." Representative Elliott Levitas (D-GA), quoted in the Anderson column, called the situation at the FCC like "the wolf guarding the flock." Figures that raised many an eyebrow also appeared, like Anderson's assessment of the frequency allocations held by 300,000 amateurs being "100 times more than available to the 9 million CB enthusiasts," plus his statement that "hams also have a lock on the higher frequencies, which are free from interference." At another point in the column, Anderson reports that "according to one confidential report, the hams now control more frequencies than all the nation's police and fire departments combined, plus all commercial and educational FM broadcasters, plus all the TV stations on the VHF channels in Los Angeles and New York City."

Anderson's column, which ap-

peared the first week of April, went on to accuse the ARRL of opposing the CB industry's attempts to gain more frequencies. And FCC Chief Engineer Ray Spence drew the biggest barb – "The Federal Communications Commission's Chief Engineer, Raymond Spence, is a lifetime member of the League. He denied that his membership is a conflict of interest."

In an interview with *73*, Spence dismissed the article as "just another Jack Anderson column." In the Personal Radio division, an aide to chief Johnny Johnston termed Anderson's conflict of interest charges "just a frivolous allegation, a typical Jack Anderson column." The aide added that he doubted that there would be any official response. As FCC sources tell it, the story got started with some of Congressman Levitas' constituents who had complained about the FCC's lack of action on Class E CB (220 MHz). The constituents, representing an unnamed Georgia CB manufacturer, wrote that they were prepared to build a plant to turn out 220 CB rigs, which would bring new jobs to the local economy. The FCC spokesman added that it was understood the EIA (Electronics Industries Association) was also lobbying Congressman Levitas on the Class E issue.

Michael Vollmer, an aide to Congressman Levitas, told a slightly different story about how the Anderson column came to be written. According to Vollmer, a constituent in Atlanta, who runs a CB factory, requested the Congressman's assistance with "an FCC problem."..Vollmer refused to name the firm, or the constituent, but added that the thrust of his request was for the Congress to investigate a conflict of interest at the FCC. Several times during our *73* interview, Vollmer emphasized that his boss is not concerned with amateurs, not out "trying to get them." "Congressman Levitas," said Vollmer, "is well aware of the fine service hams have done both at home and abroad. What bothers him the most is whether a conflict actually does exist at the FCC ... a conflict that may deny all segments of the personal communications industry an equal voice in decisions affecting it."

Vollmer, in response to a question, said that Congressman Levitas was responsible for only a small portion of the Anderson column ... but he added that the Congressman believed most of the allegations contained in it are true. Vollmer says his boss remains open-minded on the subject, however, and is anxious to receive some feedback from amateurs. (Address those cards and letters to Congressman Elliott Levitas, 329 Cannon House Office Building, Washington DC 20515.) Levitas had already received some comment at the time of our interview, mostly from amateurs, who reportedly appealed for a chance to get ham radio a bit more credit than the Anderson column gave it. Vollmer told *73* his boss planned to deliver a speech on the House floor praising amateurs for their service, but dumping on the FCC as an ill-run bureaucracy. (Congressman Levitas has requested a formal investigation of the FCC by the House Interstate Commerce Committee.)

"The Federal Communications Commission's Chief Engineer, Raymond Spence, is a lifetime member of the League. He denied that his membership is a conflict of interest. . ."

The FCC, meanwhile, had other problems. The Anderson column came at a bad time – right after a critical Federal Appeals Court decision that may stifle the kind of informal discussions many of us are accustomed to having with FCC personnel at hamfests and conventions. It was a cable TV case concerning siphoning, a practice that's been restricted by FCC rules. The regulation had limited cable TV operators' use of new films and sports events on their own channels, thus siphoning the programming from commercial broadcasters. The Federal Appeals Court not only threw out the anti-siphoning rule, but gave the FCC a real going-over on its rule making procedures. At issue are so-called *ex parte* contacts, discussions between FCC officials in decision making positions and parties interested in proposed rules. The court found that the FCC had violated its own rules, since the so-called *ex parte* contacts are not recorded for the public record. In future, FCC attorneys say, staff members with have to submit written summaries of their informal discussions on pending rule makings. That could mean a lot of paperwork, but more important, it could stifle the kind of "let your hair down" meetings FCC staffers like to hold at ham gatherings. Another byproduct of the court ruling is that the FCC will have to end the practice of accepting late comments on its proposals. Current procedures allow for comment after the deadline as a practical matter, since the staff rarely gets to the mail until after its own deadline.

FCC lawyers are considering a US Supreme Court appeal, but in the interim the Personal Radio Division is faced with a sticky problem – the largest hamfest in the US at Dayton. Dayton, in the words of one staffer, "is our biggest effort of the year," with five or six FCC officials planning to attend. At press time it was unclear what effect the appeals court ruling would have on the Dayton FCC Forum ... but as the same Commission staffer put it, "at this point we can say anything we want about pending proposals, but we can't listen."

Warren Elly WA1GUD
Assistant Editor

"The Anderson column came at a bad time – right after a critical Federal Appeals Court decision . . ."

De WA3ETD

We have been getting a number of letters here at *73* concerning excessive QRM, jamming, music, etc., on the low bands, especially on 75m. Several readers complained about nets being intentionally jammed! I have not been especially active on 75, so, armed with a new linear that needed reviewing, I proceeded over to a friend's QTH for the evening. In a few minutes we were ready to go, but it required fifteen minutes to find a spot to tune up without bombing someone. Yes, the band is crowded! However, still no music or excessive QRM, and I began to wonder if the letters were a bit far-fetched. We had a few enjoyable QSOs, giving the linear a pretty good test. Then, while talking to a station in New York, I noticed someone tuning up dead on my frequency – annoying, but not interfering with the QSO. I informed the other station that "the frequency was in use," and that did it. The character proceeded to "tune up" for the next ten minutes, and it appeared that his procedure required continuous whistling into the mike while tuning. Interesting. I also noted that the higher in frequency I went, the more acute the jamming problem was. Well, I'm a believer now, and I can assure you it will be awhile before I subject myself to the "enjoyment" of 75 in the evening.

Let's face it, ham radio is in trouble. We were lucky to escape with our frequencies when the ITU met several years ago, but only a fool can hope that the upcoming WARC will leave the ham bands unscathed. Remember, the USA has only a single vote which can be countered by *any* third world country (see the "WARC Disaster" special report in Feb. *73* for details). I can imagine what an unenlightened foreign ITU representative must think when he tunes in on our low bands.

Not only is there international pressure to trim our bands, but we are also under attack from within. The CB manufacturers would love some extra spectrum space to provide equipment for, and they have an ear in Washington. A day or two ago syndicated columnist Jack Anderson (of Watergate fame) provided the media with an attack on amateur radio. The essence of his report indicated that the hams hold much more frequency space that our numbers justify, and why should three million CBers be confined to a few kHz while we hold choice "interference-free" VHF spectrum. Mr. Anderson's sources obviously are not concerned with the future of ham radio!

NEW MODES

Lately we have been swamped with articles on power supplies and mods for the new Icom 22S transceiver. These things run in spurts; next week it will probably be quad antennas or something. Unfortunately, the people most involved in tinkering have the least time to write articles. It really doesn't take a Master's degree in English to write a good technical article for *73*. If you have a pet project cooking, especially something involving the special modes such as SSTV, RTTY, or microwaves, pass along your enthusiasm to those ready to try something new. An SASE will bring a copy of Wayne's "How To Write for *73*." This document outlines manuscript requirements and provides info about photographs, diagrams, etc. Do a fellow ham a favor and "turn him on" to a new facet of amateur radio. *73* is willing to publish almost anything relating to the special interest areas of radio, so let's hear it! A point to remember: A single article can relieve the financial bite of your latest project. The other night I was talking to a well-known EME enthusiast who indicated that writing for amateur publications had just about paid for his station – think about it.

WHAT'S COMING IN *73*

Check the new RTTY feature by Marc Leavey in this issue. RTTY is a fast-moving mode with plenty of room to experiment and tinker, and if you have been hesitant to tackle teletype for want of information, try *73*.

Marc's column will provide monthly info for the beginner, as well as advanced techniques for the RTTY pro. Some good articles are coming along in future issues. A comprehensive look at active filters for RTTY is coming, written by Pete Stark, for those requiring the ultimate in terminal unit performance. SSTV will be covered in two upcoming articles, as well as an update on Stirling Olberg's "Smoke Detector" microwave system. If you need a cheap alternative to today's expensive transceivers, try 10m with a converted CB radio – coming in future issues. The new 10 GHz "Gunnplexer" microwave transceivers have been getting a workout at *73*. Watch for technical details in the next couple of issues. Tell a friend about *73*, the home of special mode articles. I'm looking for YOUR article, so get writing.

John Molnar WA3ETD
Executive Editor

Continued

Fireworks

So you feel safe after you have disconnected or grounded the antenna feedline? Not necessarily! If you have a rotatable beam or quad, there is usually an 8 or 4 wire cable connecting the rotor mechanism with the rotor control box. This cable leads down the mast or tower into the control or operating room. Unless there is some form of disconnect between this cable and the rotor control box, part (usually too much) of the lightning surge at the antenna or tower will find its way into this cable. Very often this cable runs parallel with the coax used as an antenna feed or transmission line. This enhances the chance of capacitive pickup from the braid of the coax, since the rotor cable is usually unshielded.

In a recent case, nature added to a July 4th local fireworks display by lightning which struck the upper tip of a fiberglass quad spreader holding the 20 meter fed element of a quad at K4NE. The last six inches of the spreader disappeared, leaving a "puffball" of fiberglass resembling a feather duster or cotton cone such as one finds at carnivals. The eyebolt holding the antenna wire was unharmed, but dropped down since its support was lost. There was no damage to the antenna or coax transmission line.

All the antenna feeds were disconnected and grounded outside the shack. Yet the lightning surge entered the house through the rotor cable, burned out the CDR control box, entered the stripline 120 volt ac connection strip through the control box ac cord, passed into the receiver and exciter which had their ac cords plugged into the stripline, and caused considerable damage to the receiver and exciter. Some of this could have been avoided had the ac cords been disconnected. But the best preventive measure would have been to disconnect the rotor cable.

There is an eight-pin Jones plug disconnect in the rotor cable outside the shack now which can be connected to a grounding plug, all eight connections strapped together and wired to a ground rod. Truly a few ounces of prevention are worth a few pounds of replacement parts!

I just walked across the room and checked my CDR and a few other cables on various antennas, such as coaxial inverted V, etc., and boy, do I need to get busy on some protective grounding. I advise all readers to go now to your ham shack and check for proper grounding.

Lewis Sieck K4NE
St. Petersburg FL

Thanks to Mike and Key, *bulletin of The Greater Cincinnati Amateur Radio Association.*

Bandwidth

The widely publicized FCC docket 20777, the "bandwidth" docket, was recently commented on by the ARRL. The ARRL felt that the docket was a step too far in the "deregulation" of amateur radio, and that a "wait and see" attitude should be adopted on many provisions in the docket, such as not yet outlawing AM, and that many problems with modulated CW (MCW) in the phone bands, RTTY in the phone bands, etc., would crop up if the docket were adopted as written.

There are certainly some problems in the docket as it stands written, such as the (I think unintentional) exclusion of amateur TV from 450 MHz. But does the ARRL seriously believe that people are going to start transmitting RTTY in the phone bands, or use MCW in the phone bands? RTTY in SSB channels would be just as much of a problem to reception for the RTTY people as for the voice people. And MCW might be run occasionally for experimentation, but would be no real big problem. Has the League forgotten that there are gentlemen's agreements throughout our bands that make mutual habitation possible? How often do you hear a RTTY station outside of 14070-14105 on 20, or outside of 3600-3630 on 80? (Unfortunately, some CW stations do break this gentlemen's agreement and do intrude, but more are considerate and there is no tremendous problem.) How often do you hear SSTV outside of 14225-14235? If we receive more flexible regulations regarding the type of emissions we use, will we suddenly forget these important agreements? Will 40 years of learning go down the drain? I say no. The League has shown little faith in its own life blood, the amateur.

I don't think that the League decision rose entirely from mistrust in hams' ability to govern themselves. I think that the directors who, as a whole, formulated the League response, are long-time hams who have not been involved in the majority of the innovative new things happening in our hobby. To them the status quo is just fine, so "don't rock the boat," let's just wait and see, and join our buddies for a rag chew on whatever mode. The experimenter has been left out in the cold!

The League is us, it's the greatest thing going for us in amateur radio, and the League is concerned about the members' views. That should be obvious from the Docket 20282 survey, which also shows that the members are concerned about League policy. If you agree with me that this issue needs another look, the first step is to be sure you are an ARRL member. Then let them hear your ideas, whether they agree with mine or not, so that they can adhere to member wishes. The League is us.

Bruce Frahm WAØTAS
Colby KS

Reprinted from the Trojan Harmonic, *newsletter of the Trojan ARC, Colby KS.*

Insurance

Listening on 2 meters during recent months, I have heard numerous discussions about the problems of insuring amateur gear, particularly with regard to 2 meter mobile and hand-held equipment. There seems to be much misinformation going around, especially since there are numerous ways an insurance company may look at equipment and its situation in the mobile.

Radio gear may be insured in several ways. First of all, equipment which is permanently installed in the home is considered as household contents and should be insured against such perils as fire, extended coverage, vandalism, and theft, along with other personal property under the well-known homeowner's insurance policy. It is, in fact, automatically covered by this policy, usually subject to a $50 or $100 deductible clause.

Other equipment, such as mobile rigs, hand-helds, or otherwise portable gear, is best insured through Inland Marine Insurance.

The National Association of Insurance Commissioners has ruled under what is known as the Nation-Wide Marine Definition that ham radio equipment in automobiles and otherwise not permanently located in a structure qualifies as a subject for Inland Marine Insurance. Such coverage provides protection against all risks of physical loss or damage except for specified perils such as war, nuclear explosion, infidelity or damage while being worked on, and a few others, wherever located, worldwide.

Insurance may be provided by endorsement to your homeowner's policy just as your cameras, jewelry, furs, or musical instruments can be insured under a personal articles supplement. The rates are generally the same as for musical instruments or cameras. Should you not carry a homeowner's policy, you can purchase an Inland Marine policy known as a Personal Articles Floater on the same basis and providing the same all risk coverage.

It is well to have purchase invoices or other documents to verify values and, as the prices of equipment go up, your insurance should be likewise increased to reflect replacement value. Even though replacement at the time of the loss may be on a depreciated basis, depreciation is based on replacement cost at the time of loss and not on original cost.

The third possibility for insuring your mobile gear is as a part of your automobile policy, which may work against you at the time of loss. Should you elect to insure your gear as part of the auto, it would be well to take a Polaroid photograph of the rig installed in the car and have your agent inspect it and give the insurance company a statement along with the photo to the effect that it is a permanent installation.

When insuring your equipment, always use an itemized schedule giving a full description of all items, including crystals, serial numbers, if any, and *current* replacement value.

In spite of the feeling of many who say nasty things about insurance companies, if you insure properly and give full information at the outset, you will be treated fairly when a loss settlement is made. Should there be honest differences, you always have recourse to your state insurance department which is charged with the responsibility of assuring equitable

handling of honest claims. Just don't try to get something you are not entitled to and, by all means, read your policy as soon as you receive it and take up with your agent anything not clear.

There remains one other area of insurance which, in recent years, has become of great concern to some amateurs. This is the area of lawsuits arising from real or imagined intrusion by amateurs into the rights of privacy of others. Much has been written and voiced about the need for such protection, but apparently, few people know that such protection is readily available and some probably already have it.

Insurance companies have, for many years, offered what is known as "Umbrella Liability Insurance" which is catastrophe type protection for a person's legal liability arising from his negligent acts. You are aware of the automobile bodily injury and property damage insurance, which is now a requirement in most states, and the personal liability protection, which is Section II of a homeowner's policy. An Umbrella Liability policy covers above these policies and also covers other areas of exposure above what is known as a Self-Insured Retention, usually $250 to $1,000. Areas covered by the Umbrella, which is usually issued for $1,000,000, include "invasion of privacy," such as might arise from interference by an amateur station with home entertainment equipment, television, radio, or telephone. The Umbrella policy provides cost of legal defense, as well as paying judgments for which the policyholder is found liable, up to $1,000,000 above the amount of the Self-Insured Retention which he must bear. Such policies are easily obtained and are relatively inexpensive. If automobile insurance is carried with limits of $100,000 per person, $300,000 per occurrence for bodily injury, and $25,000 per occurrence for property damage, and if personal liability of $50,000 is carried, an individual with one dwelling and one auto can usually obtain umbrella protection for under $100 per year. Many larger businesses provide this coverage as an employee benefit at substantially lower premiums.

The insurance coverages we have discussed are readily available throughout the US and Canada. Any professional insurance agent should be able to properly insure you as a radio amateur in a short time if you sit down with him and give him the information about your equipment and operation we have discussed here. Who knows, in addition to properly protecting yourself, you may at least get the real story of amateur radio to someone else or find a budding ham.

Leonard Fowler Jr., CPCU, WA3TCE
Bryn Mawr PA

Another Milestone

Although few hams would agree, one of the best things that has happened to amateur radio has been the advent of the Citizens Radio Service, or CB. From the beginning of radio communication, the amateur service was a non-commercial user of radio frequencies and the word "amateur," denoting unpaid, inexperienced, or unskilled as compared to "professional" or full time, most certainly required strict regulations to protect the public interest up and down the radio spectrum. Like the new automobile driver, this amateur must prove to the Federal Communications Commission that he or she has sufficient radio knowledge by personal examination to put a signal on the air. Thus, the various types of amateur licenses have evolved over the years and the ham can even build and operate his own equipment.

On the commercial side, it was later shown that unskilled persons such as police, firemen, taxi drivers, pilots and others could successfully operate communications equipment that was government type approved and both installed and serviced by licensed persons. When the equipment meets quality standards and is adjusted by qualified personnel, it is evident that the technical knowledge and skill of the operator becomes less important. This latter concept could have paved the way for the CBers.

At least for the first time persons over 18 years of age could get on the air without examination merely by application. Even low power handheld units can be operated without any permit or restriction. Without doubt, the success of CB has exceeded all expectations. Not too many years ago, the radio enthusiast was asked, "Are you a ham?" Now, they nearly always say, "Do you have CB?"

The demand for CB equipment has created a bonanza for electronics manufacturers. Many new companies that jumped aboard the bandwagon have also taken a look at the much smaller (but more expensive) amateur market since the same production techniques apply. Competition has probably reduced the price of some ham gear over what it would be with fewer manufacturers. The sheer numbers of builders stand out when comparing the advertisers of 10 or 15 years ago with the present.

It may be a coincidence that the proliferation of CB has prompted the Federal Communications Commission to take a concerned look at the amateur regulations from time to time. Recent changes like elimination of special Novice calls, no advanced notice of extended portable operation, relaxed logging requirements, and others, have reduced paper work for the FCC. When your hands are full and your budget's under review, the only alternative is to look for ways to lighten the load.

Most certainly the spotlight has shifted to another milestone in radio communications. Has the Citizens Service been beneficial to amateur radio? Some amateurs are beginning to think that it has.

Reprinted from SARA News, *a monthly publication of the Schenectady NY ARA.*

Strip Your Shack

In my attempts to recruit people for our hobby, I have met with concern regarding the cost of equipment – fears that people could not afford to venture into ham radio or to convert from CB.

This is a fallacy which must be corrected by our own publications and should be put into its proper perspective. It is high time that our hobby rags publicize, via the media, that ham radio equipment is really no more expensive to the Novice than many CB rigs.

Many wrong impressions are created when we invite a would-be Novice to our shacks, where we may have a fantastic array of gear. Do you confess to him that this or that piece of equipment is oh-so-many-years old? That it has already been robbed of so many parts that it is now useless, and can never be used again except for further pilfering of parts for another project?

Stop this bull! Be honest with yourself and with him. If you cannot remove the excess gear from his sight, then, for goodness sake, at least label it as obsolete. You will feel and he will feel more at ease. For that reason my shack is stripped to the bare essentials.

It is a warm feeling to have a youngster say: "Gee whiz, is this all you really need to work across the world?"

You answer, "Yes. Control yourself, Mister. Sit down and I shall endeavor to show you exactly what I mean. New Zealand is now busy with WA6 on 15 meters but, just as soon as they complete their QSO, I will demonstrate an attempted contact."

Good fortune came my way with propagation, sunspots, and opportunity, and Frank ZL1BDG answered me. Thank you, Frank. I made a convert.

This young man is now asking me, "How quickly, how soon, and ... maybe I can use the money from my paper route."

Of course he does not understand the CW yet, but, with my persistence and influence, he will.

In most photographs with the proud owner/operator posing in his shack, I see items of equipment which are not really necessary to operate a bona fide station. Remove that excess gear, OM, and enlist a recruit.

Only after we make it a practice to remove excess gear can we hope to initiate or convert people into our ranks. The display of expensive equipment scares the hell out of them. Move out the crap and you will note an immediate and gratifying change of attitude.

I would like to upgrade my equipment, but looking over price indexes I nearly jump out of my pants. How does a prospective Novice feel when he or she perceives the staggering sums demanded by the makers of today's boxes? They are turned right off!

Forty-nine years ago, fresh from radio school, I was escorted into a destroyer force radio shack and was told I had to learn to operate the equipment. I nearly panicked.

But I learned a compatibility with those ten inch high, five inch diameter bottles, which we later learned to call tubes. Those "bottles" though, were Uncle Sam's investment and not mine ... all I had was patience, and I could afford to learn to live with them, and them with me.

Today's people, though, do not have this patience. Everything must be now! It's something else. More results more quickly, and more demands. I sympathize with them. They are the ones who will invest in the equipment, and if you would help steer more hams our way by stripping your shack of junk in order to show them just how little is needed to operate your station, we'd all be better off.

A. Paul McMonigal WB8VZW
Caspian MI

News? We need input, and one of the best sources is the club newsletter. Got one? We reiterate our longstanding offer of a free subscription to 73 *or* Kilobaud *in exchange for a spot on your ham or computer club newsletter mailing list. Deal?*

New Products

CLEGG FM-76 220 MHz TRANSCEIVER

Something has got to give on 2m FM. The band is getting so crowded in the big cities these days, that finding a clear pair is next to impossible. Even up here in New England, where terrain has long allowed local repeaters to coexist with their big city neighbors, overcrowding is becoming the order of the day. The reason? There are more amateurs active on 2m FM than all the other ham bands combined!

The movement up in frequency hasn't been as fast as many predicted. Repeaters (and simplex use) up on 450 MHz are growing slowly but steadily, fueled by easily modified surplus commercial gear and 2m control links. The growth pattern has been for groups to add 450 repeat capabilities after establishing the 2m system and sorting out a 450 control link. It is only natural, then, to go repeat on the higher band. But for a number of reasons this pattern hasn't happened on 220 MHz, the middle ground between 2m and 450.

"Use it or lose it" was the battle cry when the CB interests first started eyeing 220, and considering recent statements of a few CB manufacturers and coverage in the national media on the subject, it looks like the battle may have only just begun. FCC engineers have tested 900 MHz for CB purposes, and agree that's the place CB ought to go. Getting the whole Commission to agree may be another matter, in view of the 220 CB advocates, but at least the 900 MHz tests are a start. Another positive development is the marketing of low priced 220 MHz transceivers, and the resulting growth in 220 activity.

Activity on 220 is certainly up, especially when you consider a 50 percent increase in 220 repeater listings in the *73 Repeater Atlas* between 1976 and 1977. We are quite far away from having a 220 machine in every state, but few big cities are now without them. Another year of growth on 2m at current rates, and 220 may well become the best alternative for new repeaters. The two bands are pretty similar, with comparable propagation and antenna systems. The major difference is the lack of crowding on 220, and thus the easy availability of coordinated frequencies for repeaters. One interesting sidelight is that New England DXers have joined 220 systems, crossbanding them down to 2m in some cases, to provide a DXalert system stretching from Maine to Connecticut. All those arguments for getting on 220 aside, one of the best reasons is economics, pure and simple. What other band can you get onto for less than $200? That's new, not surplus gear!

An excellent buy, at this writing, is the Clegg FM-76 priced at $165. If your club buys in quantity (from 2 to 40 at a time) the price can go as low as $140. A call to Clegg's toll free telephone number (800-223-0250) will connect you with some more specific information on group prices and related group purchases.

The FM-76 is basic in concept, a feature I'm glad to see after testing so many 2m FM rigs overloaded with buzzers, bells, whistles, and gadgets. The simplicity is a bit misleading, however, when you consider that all the essentials (and a bit more) are there. Clegg has included receive and transmit crystal trimmers, remote speaker jack, power output switching (10 W to 1 W), a transmit indicator, a large illuminated S-meter/output meter combo, a more than adequate built-in speaker (side-mounted, not top- or bottom-mounted), and rear panel inputs for tone burst and output for a discriminator meter. The Clegg is rugged, with a strong and easily-mounted mobile bracket arrangement. Rear panel connectors are standard SO-239 for coax, with a four pin mike connector for the tone burst and discriminator connections. The FM-76 is small, and space was found in my sports car despite the presence of several other radios and a cassette deck. (I even had room for my wife left over!)

The layout, as can be seen in the photo, is simple and clean. Channel numbers are large and well illuminated, and the radio is very easy to operate mobile, day or night. Twelve channels are allowed for, with the 223.50 MHz simplex pair already installed, as standard equipment, at the factory. Clegg nets additional channels for $8 a pair, when ordered at time of purchase. Even here in New England, where we are lucky enough to have quite a few 220 repeaters, I was hard pressed to fill all 12 channels. I ended up with six repeater pairs and the simplex channel.

As this review was being prepared, winter was finally ending here in New Hampshire. So what better excuse for a climb up nearby Pack Monadnock Mountain, the official *73* test site? The mountain comes to just over 2300 feet above sea level and is better known as "Mt. Intermod" because of its uncanny ability to demoralize the best transceivers, turning their receivers into scrambled eggs . . . a maze of cross modulation, intermod, and desense. The mountain is so well located that scores of contests have been won from its peak, the site for several years of the WR1AAB repeater. This mountain, in a word, is a bear.

Getting up the mountain is a lot easier than you'd think. Since the area is a state park, a paved road is maintained during the warmer months. Our test crew was prepared with not only the Clegg FM-76 for 220, but also with some 2m radios, just for comparison purposes.

The comparison was incredible! The 2m band was a mess, with (count 'em) 4, even 5 repeaters on the same frequency in some cases. Not even going down to 1 Watt would cut the QRM. Simplex operation quickly became the only alternative, and 52 got quite a workout.

While the others worked on 2m, I set up on 220 with the Clegg. I used a magnetic mount Antenna Specialists 5/8 wave antenna. Our test rig has been factory equipped with a half dozen repeater pairs. I started out with 224.34, easily raising the Fitchburg MA repeater, and Ed K1SSH. Then we switched off to 223.50, the recognized national 220 simplex frequency. Ed was loud and clear, but soon there was a mini-pileup! (Who says there isn't activity on 220?) Five stations were worked, ranging from Acton MA to Derry NH. I was able to access four other repeaters, including Waltham MA, Quincy MA, and Chester NH. All were Q5, most of them DFQ. Activity, however, was not exactly heavy. It was difficult to get QSOs, despite the noon timing of our trip up the mountain. To say the least, it was a bit discouraging.

I began to feel better, though, as soon as I switched back to 146.52. Bedlam! The boys had quite a pileup going, and some of the stations on frequency were pretty upset — breaking the channel for a "local QSO" only . . . no DX! (It reminded me of a W2 station on 75m who used to call "CQ CQ, no kids, no lids, no space cadets who got their tickets off the top of a cracker jack box!")

Back to 220. I learned from K1SSH, via the Fitchburg machine, that activity there was up, that they were doing even better than the big Boston 220 repeaters. Another station disagreed when I QSYed to Waltham on 223.34, but it was nice to hear an argument about *increasing* activity on 220 . . . instead of the usual "use it or lose it" philosophy.

On the way down the mountain I struck up a simplex QSO with a Manchester NH station, and as I listened on the 2m rig, my companions (in another mobile) were also working a Manchester station. Both of us were running compatible power and antennas, and reports coming back on 2m and 220 MHz were about even, respectively. Interestingly enough, both of us lost our QSOs at the same point — just as we drove off the access road. It was a graphic demonstration of the surprising similarity in propagation on the two bands.

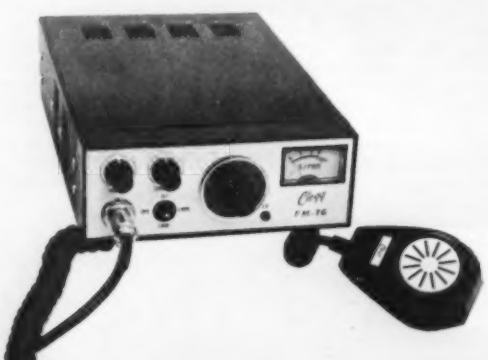
All through this, the Clegg worked flawlessly. The receiver was not affected by the strong rf fields generated on the mountaintop by several commercial repeater installations. It was easy to squelch out overload from my 2m rig, even when running a 70 Watt amplifier, without tightening up beyond the ability to hear anything through the Clegg. And audio reports off air were good, with the comments indicating sufficient deviation and audio gain.

Power output was measured in excess of Clegg's specs, with about 11.5 Watts out in the high power position, 1.5 Watts out in the low power mode. By fooling with the Antenna Specialists 5/8 wave, I was able to get the swr beyond 3 to 1, but the Clegg reacted only by reducing output in direct proportion to the increase in swr. A direct short was then set up, but no smoke! The Clegg, as outlined in the owner's manual, simply refused to transmit.

In the ham shack, the Clegg ran very well off a car battery, and played a key role in gaining several new ones during the late winter DX contests. If you never have used a DXalert repeater system, you're in for quite a surprise — it's really great to know what's happening where, and when. And when it comes to DXalert machines, the movement is growing the fastest on 220.

So, the next time you're driving home in the afternoon rush hour, waiting your turn on 2m, give some thought to 220 MHz. Wouldn't it be nice to actually have a QSO on the way home, instead of finally getting it turned over to you just as you turn into the driveway? You bet! And when you do decide to join the rest of us on 220 MHz, consider the Clegg FM-76. It is small, well built, works without any glitches . . . and the price *is* right. *Clegg Communications Corp., 208 Centerville Road, Lancaster PA 17603.*

Warren Elly WA1GUD
Assistant Editor



The Clegg FM-76 — 10 W on 220 MHz for a moderate price.

The Heathkit HR-1680 Receiver.

HEATHKIT HR-1680 RECEIVER

With the advent of the HR-1680, the folks at Heath have again surpassed themselves by making available to the newcomer as well as the seasoned operator an inexpensive yet very versatile ham band receiver. It is difficult to believe that a receiver with such sensitivity and design can still be purchased for as little as $199.95.

The cabinet, which measures 12¾" x 6¾" x 12", is in the traditional Heathkit green to blend with your existing station. The dial and S-meter are behind the newer style red dial window so they can only be seen when the receiver is turned on. The knobs are traditional Heath except for the main tuning knob, which includes a convenient finger spinner for fast frequency changes.

Going into the receiver, the construction is completely of solid state design. Four printed circuit boards make up the entire unit and each is inserted into its own socket. These can easily be removed for servicing and during initial tune-up.

Construction progressed in the normal Heathkit style with simple straightforward instructions and easy to understand diagrams. The entire building of the receiver, including tune-up, took approximately four nights of work or a total of about 16 hours. Tune-up is as easy as it could possibly be — no external equipment is necessary. However, the use of a VTVM and rf generator may improve the sensitivity to some extent. I did not notice any appreciable difference in the two methods of alignment.

The receiver covers the following frequencies: 3.5-4.0 MHz, 7.0-7.5 MHz, 14.0-14.5 MHz, 21.0-21.5 MHz, 28.0-28.5 MHz, and 28.5-29.0 MHz. Upper sideband, lower sideband, and CW modes are selected through the use of a front panel slide switch. A 100 kHz crystal calibrator is included for instant calibration of the receiver on any band.

A four pole crystal filter is provided for SSB reception, while audio filters narrow the audio response to either 2100 Hz minimum at 6 dB down for SSB or 250 Hz minimum at 6 dB down for CW. The maximum filter response is 7 kHz at 60 dB down for the wide position and 2.5 kHz at 60 dB down for the narrow position.

The sensitivity is claimed to be less than .5 microvolts for a 10 dB signal-plus-noise ratio for SSB operation. I compared the receiver to the receiver in the popular Heathkit HW-101 transceiver and found the sensitivity to be much greater in the HR-1680 while using the same antenna and switching it from one receiver to the other. The dynamic range is listed at 120 dB or greater.

Operation of the receiver is very simple. Front panel controls include af gain/power on/off, preselector tuning, rf gain, main tuning, bandswitch, function switch (narrow and wide filter and calibrate), and a mode switch (LSB-USB-CW).

The back panel includes jacks for a 4 Ohm speaker, a sidetone input from your transmitter, muting, antenna, and 13.8 volts should the receiver be run from a car battery or external power supply.

The possibilities for a receiver such as this are almost unlimited. Besides its obvious use as a primary station receiver for both the novice and the advanced amateur, it can be used as an auxiliary receiver with a transceiver for split operation. A little ingenuity on the part of the purchaser will also find many other uses for a receiver such as this around the shack.

Also available is a matching speaker, HS-1661. The speaker has an impedance of 4 Ohms and its response is tailored to SSB reception. For the additional cost of $19.95, the speaker is an excellent value to round out your HR-1680. *Heath Company, Benton Harbor MI 49022.*

Rich Force WB1ASL
Publications Editor

The Kenwood R-300 general coverage receiver.

KENWOOD R-300 RECEIVER

The parade is on! After a long drought, the electronics marketplace is being provided with an excellent choice of moderately priced communications receivers. For the past few months *73* has been reviewing this new crop of receivers, and this month I had the pleasure of checking out the R-300 by Kenwood.

The R-300 is of "classic" design, as there are no phase locked loops or other devices employed in the tuning scheme. The Kenwood tunes continuously from 170 kHz to 30 MHz, with the exception of a small gap from 410 kHz to 525 kHz. Bandspread tuning is provided for three of the six ranges, starting at 3.0 MHz. Both of the tuning dials are of the drum variety, controlled by large knobs with "rapid-twirl" indentations. A six position bandswitch controls the range, which is indicated by a green semaphore that appears next to the selected range. A combination of push-button and rotary controls round out the available operator functions. Two-position buttons control power, crystal calibrator, and panel lamp, as well as mode, noise limiter, and tone selection. The antenna trimmer, audio and rf gain, and BFO are conventional rotary controls. All functions operate smoothly, and the tuning and bandspread are without whiplash. Back panel options consist of speaker jack, antenna connections, external battery jack, and i-f module adjustments. An S-meter zero control is also provided.

This receiver functioned well on the test bench. A longwire antenna as well as the Kenwood-provided random wire were used during the test. Sensitivity is good on all bands; however, a preamp would be required for serious work on ten meters. On the other end of the dial, the sub-broadcast range was interesting. VLF enthusiasts will be pleased by the R-300, as any number of code, weather, and information stations were copied in the 170 kHz band. The crystal calibrator was most useful when calibrating the main tuning and bandspread. The main tuning can be roughly set to allow bandspread tuning, then tweaked exactly on frequency by listening for zero beat after the 'spread frequency is set. Bandspread scale increments are 20 kHz, and can be easily subdivided by eye. The BFO is stable, and it was easy to tune SSB signals accurately. My impression is that the R-300 could serve as a backup receiver for the advanced ham or Novice operator.

The Kenwood R-300 is priced at $239, a price that should interest serious SWLs and the amateur in need of a second receiver. The battery option makes it a natural for the summer season that is finally arriving. The receiver is a good value, as it is unusual to find a calibrator and full complement of controls on a rig so reasonably priced!

John Molnar WA3ETD
Executive Editor

A GUIDE TO 2M SYNTHESIZERS

When the first repeaters were developed, they were few and far between. Any given area had only one repeater and only the more enthusiastic amateurs modified their converted commercial FM transceivers to provide for a simplex channel as well as the local repeater channel. The first transistorized transceivers designed specifically for the two meter band had provisions for three channels, deemed generous in the early days. Soon, however, the availability of relatively inexpensive transceivers and the multiplication of repeater installations created a demand for 6, 12, and even 22 channels in the transceivers.

With 22 channels (some areas support 22 or more repeaters), the cost of crystals becomes a major factor. At $5.00 a crystal it could cost over $200 just to fill all the positions in the transceiver, and even then you would not have the flexibility needed in some areas of the country. To move to another area could be a financial disaster.

More and more amateurs are turning to synthesizers to solve this crystal problem. The manufacturers have come out with a variety of adaptors and complete rigs which eliminate any need to buy lots of crystals, and which will access almost all repeaters and all simplex channels.

This article is designed to summarize the important characteristics of most of the synthesizers available for two meter FM. Only FM (and not the allmode) rigs are considered here.

Table 1. List of synthesizers and synthesized transceivers.

Equip.	Range (MHz)	Offsets	Stab. (ppm)	Temp. (°C.)	Spurs (dB)	Power	Wt. (lbs.)	Size ($in.^3$)	Xceive	Cost
1. Amcomm	143-149	R + S[1]	10	-20 +60	60			187	Yes	500
2. B'stone 144	143-150	S + all	10	-11 +54	70	High	8	313	Yes	480
3. SC 1800 M	145-148	R + S + 3[2]			60	Low		67	No	225
4. CE 2001[3]	146-148	R + S	20	0 -38	45	Low			No	300
5. Clegg FM-DX	143.5-148.5	R + S + 3	5	0 -50	66	High	7	262	Yes	600
6. MFA-22	144-148	R + S + all	5	-10 - ?	?	High		137	No	300[4]
7. Mid 13-510	144-148	R + S + 2						171	Yes	390
8. GLB 200	146-148	R			60	Low			No	260
8. GLB 300	144-148	R + S	5	-10 +50	60	High		79	No	135K[4]
8. GLB 400B	144-148	S + all	5	-10 +50	60	High		111	No	150K[4]
9. WE-800	144-148	R + S				Low	2	102	Yes	390
10. TR-7400 A	144-148	R + S		-20 +50	60	High	6	216	Yes	400
11. VHF SYN II	140-150	R + S + 3	10	0 -50		High	1½	110	No	170K
12. Icom 22S	146-148[5]	R + S			60	High	4	120	Yes	290
12. Icom DV 21	146-148	all[6]			60	High	11	234	No	390
12. Icom IC-245	146-148	R + S + all	10	-10 +60	60		6	200	Yes	500
13. EBC-144 Jr	143.5-148.5	R + S + all	10	0 -55	60	High	6½	245	Yes	530
14. Vanguard	Any 10 MHz	none	5	-10 +60				36	No	160[4]
15. KDK FM 144	144-149[7]	R + S	20	0 -50	60	High	5	104	Yes	390
16. HW 2036	144-148[7]	R + S + 1	15	-10 +50	50	High	6	223	Yes	270K
17. VHF/ONE	144-148	R + S	2	-10 +50	60	Low	4	160	Yes	350
18. Yaesu 200R	144-148[7]	R + S[8]				High	7	247	Yes	450[9]

[1] ± 1 MHz also available.
[2] Special Channel Memory.
[3] For use only with a Motorola HT-220, and fits inside omni case.
[4] Costs less without 5 kHz capability.
[5] Any 22 channels.
[6] Programmable for any split; will automatically scan band.
[7] Will cover only 2 MHz without retuning.
[8] No 5 kHz spacing available.
[9] No longer in production; some units available from Amateur Electronic Supply for $300.

A description of these rigs is given in Table 1.

An explanation of the columns in that table is given here.

Col. 1 — Lists the name of the unit. The number refers to the manufacturer or main distributor, with address and telephone number, in Table 2.

Col. 2 — Lists the frequency range covered by the synthesizer.

Col. 3 — Lists the various offsets available. R stands for plus and minus 600 kHz. S stands for simplex. The number of switch-selected offsets is also given. *All* implies that the transmit and receive frequencies can be independently selected and hence cover any repeater split.

Col. 4 — Lists the frequency stability in parts per million (1 part per million implies a frequency uncertainty of about 150 Hz at two meters).

Col. 5 — Lists the temperature range, in Celsius degrees, associated by the manufacturer in the specifications.

Col. 6 — Lists the degree of suppression claimed for spurious frequencies (not harmonics).

Col. 7 — Indicates the power consumption of the synthesizer. Those labeled low are usually based on CMOS ICs and will consume less than 10 mA.

Col. 8 — Lists the weight of the unit in pounds.

Col. 9 — Lists the size of the unit in cubic inches.

Col. 10 — Differentiates between synthesizers alone and synthesized transceivers.

Col. 11 — Lists the costs of the unit, with a K indicating the cost of an unassembled kit.

If no entry appears in any column, it means that the manufacturer does not establish a value for that quantity or that information was not available when the table was prepared.

There is a lot of information in the main table; however, there is a lot of important information which cannot be given in any table. Quality of construction is one type which is impossible to objectively present. The completeness of instruction manuals and the availability of service has not been considered. Neither have the terms of any warranty or the reputation of the manufacturer. Few companies will tell you how long it takes a unit to lock onto a frequency. If any unit has special features of great significance, a footnote to the table so indicates.

Some of the columns will be of greater interest to some prospective buyers than to others. At the present time, there is not much FM activity below 146 MHz. Hence it is of little importance to most amateurs whether the synthesizer covers 145 MHz or not. But 144-145 MHz coverage is of great importance if the transceiver is to be used overseas in areas where repeater activity is below the US frequencies. Furthermore, if the repeater to be used is a MARS repeater, the synthesizer must cover the frequencies just outside the two meter band.

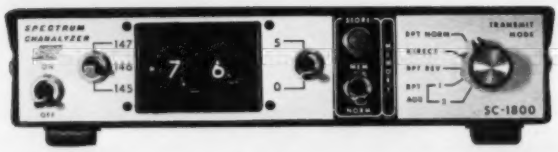
If your area contains no repeaters with an oddball separation, you need not be concerned about any offsets other than the regular 600 kHz up and down and simplex. But, if you travel a lot, the availability of a nonstandard offset might be important.

The next three columns have to be treated with a certain amount of skepticism. Here there is a lot of room for specmanship. The definition of stability at one company may not be the same at another. This difference in definition is particularly important when considering a quantity like spurious output. The Heath company, for instance, lists their spurious output as better than 70 dB down within 20 MHz of the carrier, but only 50 dB down if one goes further away. Another company might just forget about those spurs at the greater distances from the carrier. Heath claims only 40 dB of suppression for harmonics. It is safe to say that most of the other companies could not apply their spurious suppression claims to their harmonics either.

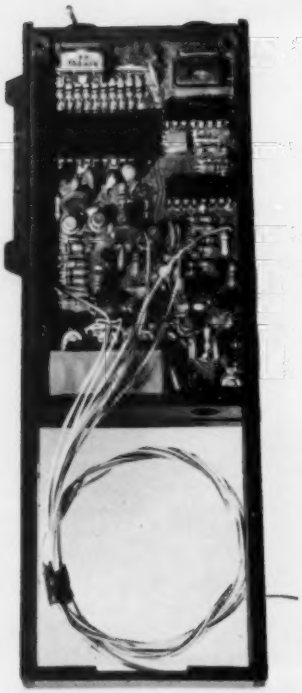
The power consumption will be of interest only to those who contemplate battery operation away from an automobile or other charger — as with

The Icom IC-22S and matching Engineering Specialties Synthacoder 22.

The VHF Engineering Synthesizer II.



Spectrum Communications SC-1800.



Communications Electronics CE2001 synthesizer module for use in the Motorola HT-220 HT.

Table 2. Names, addresses, and telephone numbers of manufacturers.

1. Amcomm
   730 West McNab Road
   Fort Lauderdale FL 33309
2. Tec-Kam Inc.
   2916 Arnold Ave.
   Salina KS 67401
   (913) 823-2235
3. Spectrum Communications
   Box 140
   Worcester PA 19490
   (215) 631-1710
4. Communication Electronics
   Box 1002
   Ann Arbor MI 48106
   (800) 521-4414
5. Clegg Communication Corp.
   208 Centerville Road
   Lancaster PA 17603
   (800) 233-0250
6. RP Electronics
   Box 1201
   Champaign IL 61820
   (217) 352-7343
7. Midland International
   Box 1903
   Kansas City MO 64141
   (913) 384-4200
8. GLB Electronics
   60 Autumnwood Dr.
   Buffalo NY 14227
   (716) 668-0566
9. Wilson Electronics Corp.
   4288 S. Polaris Ave.
   Las Vegas NV 89103
   (702) 739-1931
10. Trio-Kenwood Communications, Inc.
    116 East Alondra
    Gardena CA 90248
    (213) 770-4350
11. VHF Engineering
    320 Water St.
    Binghamton NY 13901
    (607) 723-9574
12. Icom West, Inc.
    13256 Northrup Way
    Bellevue WA 98005
    (206) 747-9020
13. Emergency Beacon Corp.
    15 River St.
    New Rochelle NY 10801
    (914) 235-9400
14. Vanguard Labs
    196-23 Jamaica Ave.
    Hollis NY 11423
    (212) 468-2720
15. Amateur-Wholesale Electronics
    8817 SW 129th Terrace
    Miami FL 33176
    (304) 233-3631
16. Heath Co.
    Benton Harbor MI 49022
    (616) 982-3411
17. Henry Radio
    11240 W. Olympic Blvd.
    Los Angeles CA 90064
    (213) 477-6701
18. Yaesu-Musen USA, Inc.
    7625 E. Rosecrans No. 29
    Paramount CA 90723
    (213) 633-4007

an HT, perhaps. The power consumption is basically a function of the complexity of the circuit and whether the ICs used are of the CMOS (low power consumption) or TTL (relatively high power) type.

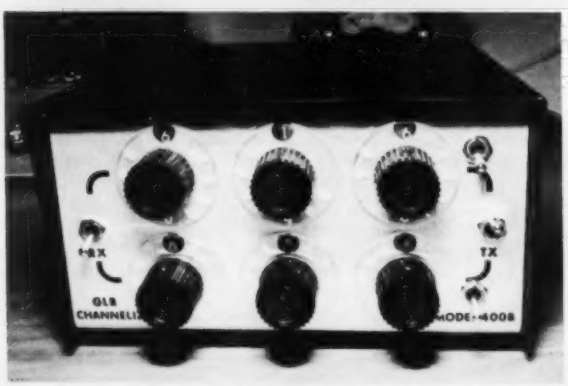
Size may be a limiting factor if the unit is to be added to an existing mobile installation or if the available space is small.

Most of the units listed are complete transceivers, but some are designed to replace the crystals in existing rigs. No attempt has been made to indicate with which rigs the various outboard synthesizers will work. The best way to find out if a given unit is compatible with your particular rig is to write the manufacturer whose synthesizer you are considering.

Of course, everybody is concerned with the price. Like calculators, the price has been coming down, and I expect that trend to continue. But I know of nobody who will predict how far down the price of a good rig will go, or how fast the price will fall.

There have been advertised two synthesizer-related pieces of equipment worth mentioning. Engineering Specialties (Box 2233 Oxnard CA 93030, phone 805-486-0817) has offered a Synthacoder for $87.95. This unit is designed to plug into the Icom 22S to permit any channel to be dialed into the Icom by thumbwheel switches. Thus, the owner of that rig would no longer be limited to the 22 channels usually provided by hand-wired diodes.

The other interesting unit is offered by Amateur-Wholesale Electronics



The GLB Model 400B.

The Vanguard Synthesizer.

The Janel Labs QSA 5 preamplifier, which can handle up to 30 Watts of transmit power through automatic switching.

(see number 15 in Table 2) for owners of the KDK FM 144. The FMSC-1 Scanner plugs into that rig and permits it to automatically scan a selected 1 MHz portion of the two meter band. Its introductory price is about $170, and it is easily installed.

Of course, this newest segment of the two meter FM market is changing rapidly and new products are coming in faster than old products are disappearing. But the tables presented here should give you a good idea of the variety of equipment presently for sale, as well as some idea of the state of the synthesizer art with which to compare any new equipment that you come across.

Alex F. Burr W5QNQ
Las Cruces NM

EDGECOM SYSTEM 3000

Edgecom of Torrance CA has announced a new microprocessor-based 2m transceiver. The new rig features programmable priority channels, monitor alarms, a built-in scanner, subaudible tone encoder/decoder, variable frequency offsets, and push-button frequency control. Output is adjustable up to 25 Watts from 1 Watt. The System 3000 will sell in the under-$500 price class. *Edgecom Inc., 2909 Oregon Ct. #A3, Torrance CA 90503.*

70 WATT, FM/AM/CW/SSB 2 METER AMPLIFIER

A new 70 Watt, 4 mode, 2 meter amplifier has been introduced by VHF Engineering of Binghamton NY. This new amplifier, the Blue Line BLC 10/70, is designed to be used with the popular 10 Watt FM transceivers and the popular multimode transceivers in the 5-15 Watt class and will deliver 70 Watts output in both the class C mode and the linear mode. A front panel switch permits simple selection of class C or linear mode. An additional model, the Blue Line BLC 2/70, offers the same features as the BLC 10/70 but will operate with transceivers or transmitters in the 1 to 2 Watt class.

The VHF Engineering Blue Line series of amplifiers have been designed for reliability and long life and feature unique broadband, stripline designs, which require no tuning or adjustment during their lifetime. Automatic sensing and relay switching are provided to automatically switch the amplifier into the circuit when drive is applied in the class C (FM) or linear (SSB) modes. The amplifiers offer high efficiency and introduce a receive insertion loss of less than 1 dB. They are designed for 12-14 V dc operation in base station or mobile service. *VHF Engineering, 320 Water St., Binghamton NY 13902.* The BLC 10/70 sells for $139.95 and the BLC 2/70 sells for $159.95.

NEW 80 WATT, LINEAR/CLASS C, 450 MHZ AMPLIFIER

A new broadband, high efficiency, 4 mode amplifier for the 420-450 amateur band has been introduced by VHF Engineering of Binghamton NY. This new amplifier, the Blue Line, BLE 10/80, will deliver 80 Watts output in either class C or linear mode with a nominal 10 Watts input. It is designed as an amplifier to be used with FM, AM, SSB, or CW rigs in the 10 Watt class. A similar amplifier, the Blue Line BLE 30/80, is designed to be used as an amplifier for rigs in the 30 Watt class.

The Blue Line series of amplifiers from VHF Engineering are high efficiency, broadband, stripline amplifiers, which have been designed for long life and reliable operation. Because of their unique, broadband design, they contain no tunable or adjustable components. Tuning or adjustment will not be required during the lifetime of the units. Automatic transmit/receive switching is provided through the use of sensing circuitry which detects the presence of drive power in either the class C (FM) or linear (SSB) modes. They are designed for 12-14 V dc operation in base station or mobile service. *VHF Engineering, 320 Water St., Binghamton NY 13902.* The BLE 10/80 is $289.95 and the BLE 30/80 is $259.95. Both units are wired and tested.

JANEL LABORATORIES MODEL QSA 5 PREAMPLIFIER

A new two meter preamp has been introduced by Janel Labs. This preamp is specially designed to improve the sensitivity of transceivers and includes all necessary bypass circuitry for carrying transmit power through the unit. The low noise figure of the preamp gives excellent sensitivity for weak signals. An adjustable delay circuit (similar to that used in VOX circuits) allows for use on all modes — FM, SSB, AM, and CW.

The gain of the QSA 5 has been optimized for transceivers. The 15 dB gain level is sufficient to improve the sensitivity as much as is practical, but low enough to avoid creating unnecessary overload problems.

A front panel switch is included on the QSA 5 to disable the preamp from the antenna line. This allows one to cut the gain on local signals and also allows for experimentation on weak signals. A LED pilot light is used to indicate when the preamp is in the line. This same LED also indicates when transmit power is being sensed.

The QSA 5 is available from *Janel Laboratories, 3312 S.E. Van Buren Blvd., Corvallis OR 97330.* The unit is available from stock at $39.95 plus postage. A full 1 year warranty is provided.

NEW SIGNETICS LSI CIRCUIT PRODUCES HF AND VHF SIGNAL GENERATION

A frequency synthesizer that uses digital phase locked loop techniques to generate radio frequency signals in the HF and VHF range is now available as a large scale integrated (LSI) circuit from Signetics.

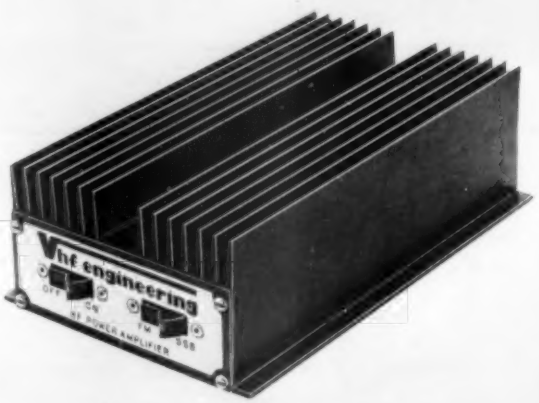
With low power Schottky and emitter coupled logic (ECL) technologies integrated into a single substrate, the new Signetics circuit, designated 8X08, operates at 80 MHz input frequencies with typical system power of 1.6 mW per gate.

As unique design features, the 8X08 incorporates an onboard reference crystal oscillator and an ECL prescaler, according to Dr. John Nemec, Product Planning Manager in Signetics' Logic Division.

Dr. Nemec said the new frequency synthesizer is expected to have major applications in the design of aircraft and marine radio equipment, in instrumentation circuits such as for signal generation in test equipment, as well as in synthesized AM/FM radios.

The 8X08 provides the major functional elements of a phase locked loop frequency synthesizer within a single LSI device. A VCO and loop filter are all that are required to complete the synthesizer circuit. The 8X08 contains all other major functional blocks, including a fixed frequency reference oscillator and divider chain, a phase comparator, and a programmable

The Edgecom System 3000 microprocessor-based 2m transceiver.



The new VHF Engineering Blue Line series of VHF/UHF amplifiers.

Heath's new HD-1426 field strength meter.

counter chain for channel selection.

The fixed prescaler for the FM input is a key to the design since it is required in phase locked loops where very high frequencies are to be generated as a means of dividing the local oscillator frequency down to a frequency compatible with the programmable counter, Dr. Nemec said.

In the 8X08, the ECL prescaler is utilized to make possible programmable channel spacing to 100 kHz for FM-receiver local oscillator generation, when using a 3.6 MHz reference oscillator crystal and an external ÷2 circuit. A total of 2000 channels is possible when using the FM input.

Operating features of the circuit include maximum power dissipation of 680 mW and a single 5 V power supply. *Signetics, 811 East Arques Avenue, Sunnyvale CA 94086.*

HEATH HD-1426 FIELD STRENGTH METER

Heath Company, Benton Harbor, Michigan, has introduced a new kit for amateur, CB and marine radio operators. The HD-1426 field strength meter measures the relative field strength of signals from transmitters from 1 to 1000 Watts covering 1.8 MHz to 250 MHz. It can be used to check transmitter operation and to make transmitter and antenna adjustments. The HD-1426 will function with any transmitter having an output from 1 to 1000 Watts.

The HD-1426 incorporates both a built-in printed circuit antenna and a whip antenna as well. It may be used as either a mobile or fixed station device, and is mail order priced at $10.95.

For more information about the HD-1426, send for a free copy of the latest Heathkit catalog. *Heath Company, Dept. 350-23, Benton Harbor MI 49022.*

NEW MOTOROLA HEP CATALOG

Motorola's HEP semiconductors are offered as replacements for over 60,000 different discrete devices and ICs. Intended for, but not limited to, the hobbyist, experimenter, and the professional service technician/dealer, the HEP products are specified to meet or exceed the important mechanical and electrical characteristics of the replaced device. In many cases, one HEP device will be recommended as the replacement for a large number of components. Because of this one-to-many ratio, the HEP device specifications will often exceed some of the specifications of a number of the replaced devices.

Because Motorola is not responsible for the design of the circuits in which HEP products are installed, and because the HEP device parameters may exceed the original, Motorola Semiconductor Products does not guarantee that the HEP device will perform exactly as the original device. However, the availability of this vast array of potential replacement devices, through a large national network of retail outlets (over 1500), can offer a considerable savings of time or money, or both, to the hobbyist and professional technician alike.

The latest edition of the *Motorola HEP Semiconductor Cross Reference Guide and Catalog* was scheduled for May, 1977. This 184 page book describes discrete silicon and germanium power transistors, thyristors, small-signal FETs and bipolar transistors, CB rf power transistors, zeners, rectifiers, and optoelectronic devices. Digital ICs, in RTL, HTL, DTL, TTL, and CMOS technologies, are also included as well as linear bipolar radio/television ICs, voltage regulators, op amps, etc.

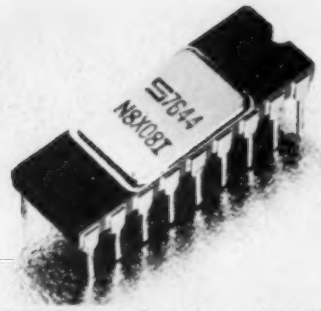
One hundred ninety-eight new products have been added to the *Catalog* — 104 are newly offered TTL functions. Industry popular TO-220 packaged components are also included. A single chip, 3½ digit DVM IC that utilizes CMOS technology to provide both linear and digital circuit functions is also covered. The Catalog also described the Educator II microcomputer and power supply kits.

The unit price of this new *Motorola HEP Semiconductor Cross Reference Guide and Catalog* is $2.00, available from HEP/MRO Operations Headquarters and HEP distributors. *Technical Information Center, Motorola Semiconductor Products, Inc., PO Box 20294, Phoenix AZ 85036.*

GOLD LINE MICROPHONE CLIP

A new microphone clip (the No. 1108) has been introduced by Gold Line Connector of East Norwalk CT. A Gold Line spokesman said that it is sometimes inconvenient, or very undesirable, to drill holes or to rely on a magnet to hold your mobile microphone in position on the dash of your car or truck. The 1108 is backed with a rugged adhesive that gives excellent holding power. It can't vibrate or pull free.

Gold Line designs and produces a complete line of accessories, including noise filters, antenna matchers, coax switches, and wattmeters, to name a few. *Gold Line Connector, Inc., PO Box 893, East Norwalk CT 06855.*



The Signetics 8X08 Frequency Synthesizer — digital PLL techniques to generate rf in the HF and VHF range.

GOLD LINE NOISE FILTERING HOOKUP HARNESS

A new noise filtering hookup harness (the No. 1106) for the two-way communications market has been introduced by Gold Line Connector. A company spokesman commented that noise affecting two-way communications is generated from various sources in your automobile and is picked up by either the radio antenna or the vehicle wiring that supplies power to the communications equipment.

The primary function of the 1106 is to reduce the noise picked up by the wiring. Double barreled filtering action is supplied by heavy-duty coaxial cable for the power pickup which shields against unwanted noise and a ferromagnetic filter that further reduces any remaining interference.

Gold Line designs and produces a complete line of accessories for the two-way communications market, which it sells through a national distributor system. *Gold Line Connector, Inc., PO Box 893, East Norwalk CT 06855.*

The Gold Line noise filtering harness.

FCC

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554
Docket No. 20777
RM-1429 RM-2163
RM-2170 RM-2330
RM-2429 RM-2507
RM-2545 RM-2550

In the Matter of

Deregulation of Part 97 of the Commission's Rules regarding emissions authorized in the Amateur Radio Service.

FIRST REPORT AND ORDER

Adopted: March 2, 1977;
Released: March 10, 1977
By the Commission:

1. A Notice of Proposed Rule Making in the above-captioned matter was released April 22, 1976, and published in the Federal Register on April 28, 1976 (41 FR 17789). The deadline for submission of comments by the public was June 23, 1976. Reply comments were due by July 23, 1976. In response to a petition by the American Radio Relay League, the time for filing comments and reply comments was extended to August 4, 1976, and September 3, 1976, respectively.

2. Docket 20777 proposed to revise the amateur rules regarding authorized emissions. Rather than attempt piecemeal reform, the Notice proposed to delete all references to specific emission types and to replace them with limitations on the permissible bandwidth an amateur signal may occupy in the various bands. Additionally, the Notice proposed a purity of emissions standard which would replace the present regulations.

3. A total of 333 persons and 8 clubs filed individual comments. In addition, 23 petitions were filed as comments, adding 625 names. All of these comments are being carefully reviewed. This First Report and Order will address the problem of purity of emissions only. A future Report and Order will deal with the major issue of authorized bandwidths.

4. The present statement of Commission policy regarding emission purity in the Amateur Radio Service is found in Section 97.73 of the Commission's Rules. Section 97.73 states in part that "[s]purious radiation from an amateur station being operated with a carrier frequency below 144 megahertz shall be reduced or eliminated in accordance with good engineering practice . . ." The United States, as a signatory to the International Telecommunications Convention (Geneva, 1959) is bound to the international standards of emission purity. Article 12, Appendix 4 of the Radio Regulations of the I.T.U. requires an attenuation of 40 dB for spurious emissions below 30 MHz, and 60 dB[1] for emissions between 30 MHz and 235 MHz. By this Report and Order, the Commission brings amateur rules into conformity with international standards.

5. Standards for emission purity in the Safety and Special Radio Services are based on the nature of the signal transmitted. The modulation of the transmitted signal produces sidebands needed to carry information to the receiver, plus additional products caused by the modulation and amplification process. It is difficult to suppress completely the undesired emission products without causing unacceptable suppression of the sidebands carrying the information being transmitted. A reasonable degree, however, of suppression of the undesired emissions is needed. This is achieved by a three-step approach. For example, the Land Transportation Services require that for spurious emissions removed from the authorized bandwidth by more than 50 percent but less than 100 percent of the authorized bandwidth, the mean power must be attenuated at least 25 decibels below the mean power (P_m) of the emission. For emissions removed by more than 100 percent but less than 250 percent of the authorized bandwidth, attenuation must be at least 35 decibels below P_m. Beyond 250 percent, attenuation must be either 43 dB + 10 $\log_{10}$ P_m or 80 dB below P_m, whichever is less attenuation. This three-step attenuation is what can most likely be obtained with the usual tuned circuitry of rf amplifiers. Beyond 250 percent is considered a reasonable point to have other additional circuitry which will provide the attenuation we wish for the other spurious and harmonic emissions.

6. The standard proposed for amateur radio in our Notice in Docket 20777 was at least 40 dB for emissions removed from the authorized bandwidth by 250% or more of the authorized bandwidth. In determining a level of emission purity for the amateur service, the 25 dB and 35 dB steps were not proposed since it was intended to have this rule remain simple. The adjacent channels which the first two steps might affect would generally be within the amateur bands and the maintenance of non-interference would be handled on a self-enforcing basis among amateurs. However, beyond 250% there exists an entire range of spurious and harmonic emissions which could create problems outside the amateur bands, and would not be as obvious to the operator until a case of interference occurred.

7. The 40 dB specification was proposed as a first step toward the problem of purity of emission. 40 dB represents an attenuation of spurious and harmonic emissions to a level of 1/10,000 that of the fundamental. This means that for an amateur station which has a 200 Watt output, spurious emissions may be no more than 0.02 Watts. Therefore, 40 dB should provide a degree of protection to operations which would not be affected by interfering signals of 0.02 Watts or less. The effects will vary from location to location, from band to band, and for different emission modes. It is a level of attenuation which the Commission believes can be readily met by most equipment on the market today, and would not require expensive remodeling of equipment by the amateur. It will, however, restrict the use of linear amplifiers which are not meeting what the Commission regards as minimal standards of purity. In a memorandum to the Office of Chief Engineer written November 26, 1976, FCC/OCE LAB Projects 82-025, 82-026, 82-027, 82-028, the Laboratory Division detailed the results of tests of linear amplifiers purportedly sold for use in the Amateur Radio Service which indicate that many such amplifiers achieve harmonic suppression far less than 40 dB, especially in the second and third harmonics.

8. The new rule, as adopted, is a modification of the rule proposed in the Notice of Proposed Rule Making. Because there has been no decision regarding Docket 20777's proposed bandwidth rules, we are unable to enact the rule as proposed. Section 553(a)(3) of the Administrative Procedures Act requires that general notice of a rule contain either the terms of substance of the proposed rule or a description of the subjects and issues involved. Therefore, in keeping with the scope of this rule making, we are adopting the international standards of emission purity which generally relate to the 40 dB level of attenuation proposed by Docket 20777.

9. The International Telecommunications Convention of 1959 requires that all spurious emissions be attenuated by 40 dB when transmitting on frequencies below 30 MHz. When utilizing frequencies between 30 and 235 MHz, transmitters with power output below 25 Watts will be required to attenuate their spurious emissions by 40 dB; transmitters with power output of 25 Watts or more will be required to attenuate their spurious emissions by 60 dB. Amateurs operating near the edges of amateur bands should give due consideration to these attenuation requirements. We consider these international standards to be a minimal level of purity, but to have required higher levels of attenuation would not have been within the scope of this proceeding. The Commission will be instituting a rule making to investigate the need for higher levels of spurious emission attenuation in the Amateur Radio Service. Additionally, upon the disposition of Docket 20777, Section 97.73 will be modified to reflect the docket's final outcome.

10. We received 12 comments specifically addressing the proposed change in emission standards. Of the 12, 2 supported the rule change fully, 2 supported some definite standards, but offered a different standard of emission than the one proposed by the Commission, 5 expressed misgivings over the expense to the amateur and the enforcement of such a standard, and 3 expressly preferred the present standard. Of those who either expressed misgivings or opposed the change entirely, the comments of John V. Durant of Albuquerque, New Mexico, are typical: "From a pure technical standpoint, determination that the emission is at least 40 dB below the peak output power on any frequency removed from the upper and lower limits by more than 250% is a controversial (subject to several interpretations) and a very sophisticated measurement. I do not believe that even 1% of the presently licensed amateur radio operators have the capability or will attempt to acquire the capability to make such a measurement. Further, I doubt that from an enforcement standpoint (presumably FCC monitors) that such a regulation is enforceable." Other comments raised similar issues: the expense of obtaining equipment to monitor the spurious emissions; the resultant lack of adherence to the new rule by the bulk of amateurs; and the difficulty of enforcing the rule.

11. The problem of enforcement mentioned by several comments would be no greater than enforcing any of the standards of Section 97.61 through 97.73. Investigation of interference complaints and normal FCC monitoring will bring the obvious violations to light. However, establishment of a readily measured standard will provide a clearly defined measurement by which to determine compliance. "Good engineering practices," the present standard, has proved to be too indefinite a regulation to enforce effectively. The change, rather than hampering enforcement, should aid it.

12. Finally, we note that two of the comments offering technical criticism of the emission standards as proposed make valid arguments. James E. McShane of Omaha, Nebraska, states, "The proposed section 97.65 and 97.73 bandwidth limitation standards do not take into consideration the range of amateur power usages, from 1/10 of a Watt to the proposed 2.0 kW spread . . . Different regulations should be adopted for low power operation and equipment, or in the alternative, the regulation should be based on a minimum specified power, or actual power, whichever is greater." Gordon Schlesinger of San Diego, California, comments, "I propose that the Commission bring the stated purity standard of 40 decibels of attenuation below peak carrier power more closely into line with the standards existing in the Land Mobile service. A standard of 40 dB + 10$\log_{10}$ (peak carrier power, in watts) would establish an absolute standard for attenuation of spurious emissions. Since power delivered to the input terminals of a receiver is proportional to the absolute (not relative) output power level of the transmitter whose emissions are being received, it makes sense to require maximum absolute limits to spurious radiation in the Amateur Service."

13. The above comments are well-taken. As Mr. McShane proposed, we have adopted the ITU regulations with respect to certain low power transmitters. Moreover, the Commission would like to note that the Notice of Proposed Rule Making, Docket 21000, which proposes increased attenuation for spurious emissions in the Personal Radio Services, contains a statement of Commission policy which promises future Notices addressing the matter of harmonic and spurious attenuation for all other services below 1 GHz, including Amateur radio. We would like to reaffirm that statement here and suggest that the above comments are excellent examples of the ideas the Commission will be seeking. Adoption of these present emission standards will not end the Commission's interest in purity of emissions, and we solicit noteworthy comments such as the above in future proceedings.

14. Additionally, the Commission has recently proposed in Docket 21117 type acceptance for commercially marketed amateur equipment. The type acceptance standards proposed would require a 43 + 10 log (mean power in Watts) decibel suppression of spurious emissions, a standard similar to the one suggested above by Mr. Schlesinger. As stated in the Notice of Proposed Rule Making, this degree of attenuation would apply only to amateur equipment which would be commercially marketed. Home-made equipment would be exempt from this standard and therefore adoption of Docket 20777's proposed standards is necessary to bring the entire amateur community into conformity with existing international standards. Until adoption of a Report and Order in Docket 21117, the standards herein specified shall apply to both home constructed and commercially marketed amateur equipment.

15. In view of the foregoing, we are of the opinion that the amended rule as discussed above is in the public interest, convenience, and necessity. Authority for this Amendment is contained in Section 4(i) and 303 of the Communications Act of 1934, as amended.

16. Accordingly, IT IS ORDERED, effective April 15, 1977, that Part 97 of the Commission's Rules IS AMENDED as set out in the attached Appendix. IT IS FURTHER ORDERED that this proceeding IS CONTINUED.

FEDERAL COMMUNICATIONS COMMISSION
Vincent J. Mullins
Secretary

APPENDIX

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended as follows:

In §97.73, the headnote and text are revised, as follows:

§97.73 *Purity of emissions.*

(a) The mean power of any spurious emission or radiation from any amateur transmitter or external radio frequency power amplifier being operated with a carrier frequency below 30 MHz shall be at least 40 decibels below the mean power of the fundamental without exceeding the power of 50 milliwatts. For equipment of mean power less than 5 Watts, the attenuation shall be at least 30 decibels.

(b) The mean power of any spurious emission or radiation from any amateur transmitter or external radio frequency power amplifier being operated with a carrier frequency above 30 MHz but below 235 MHz shall be at least 60 decibels below the mean power of the fundamental. For transmitters having mean power of 25 Watts or less, the mean power of any spurious radiation supplied to the antenna transmission line shall be at least 40 decibels below the mean power of the fundamental without exceeding the power of 25 microwatts, but, in any event, need not be reduced below the power of 10 microwatts.

(c) Spurious emission or radiation from an amateur transmitter or external radio frequency power amplifier being operated with a carrier frequency above 235 MHz shall be reduced or eliminated in accordance with good engineering practice.

[1] 40 dB for transmitters having mean power of 25 Watts or less.

(d) For the purposes of this section, a spurious emission or radiation is any emission or radiation from a transmitter or any external radio frequency power amplifier which is outside of the authorized Amateur Radio Service frequency band being used.

(e) The above notwithstanding, should any spurious radiation, including chassis or power line radiation, cause harmful interference to the reception of other radio stations, the licensee may be required to take, such further steps as may be necessary to eliminate the interference in accordance with good engineering practices.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

In the Matter of

Report and Order Number 20777
Grandfather Clause

To: The Commission

ENDORSEMENT OF REPORT AND ORDER #20777

The Amateur Radio Manufacturer's Association (ARMA) was formed on January 7, 1977, at a general meeting of all manufacturing interests attending the SAROC Convention in Las Vegas, Nevada. The organization is a self-governing body formed in order to encourage high standards and ethics in the Amateur Radio Industry. The basis and purpose of ARMA is to promote the general growth and welfare of amateur radio and to work toward favorable rule making and legislation for the benefit of the industry, as well as to function as a liaison between the member firms and the Federal Communications Commission (FCC). ARMA is also intended to collect and to disseminate market information to the members.

The membership of ARMA generally applauds Report and Order Number 20777: At long last, we will have some concrete specifications from which to engineer our products rather than merely following good engineering practices.

We are aware of the decision-making power which must go into this rule making, but we have also come to realize that there is a grave oversight on the part of the FCC in one area. This is the subject which we wish to follow up with the FCC, in the form of this petition for a "grandfathering" (grandfather clause) of commercially-built amateur radio transmitter and transceivers manufactured prior to April 15, 1977.

The reasons for this petition are as follows:

1) These products have been built by the legitimate Amateur Radio manufacturers who have not violated good engineering practices or the "spirit" of the law. Should these manufacturers be forced to take back the equipment from inventory of their stocking distributors it would be a significant hardship, possibly to the point of Chapter 11 filings.

2) The distributors and retailers would be faced with horrendous inventories of non-salable used equipment on the shelves.

3) The Amateur Radio Operator as an individual would be adversely affected once again with financial burden when he discovers that his present equipment is no longer legally marketable for outright sale or for trade-in on new equipment that does meet the specifications in Report and Order #20777.

4) The legitimate, self-policing Amateur Radio fraternity and industry would be dealt an injustice brought on by the pseudo-Amateur Radio violating the spirit of the law.

We wish to have the present equipment which does not currently cause harmful interference to other services put under this grandfather clause. And, we feel, this action in addition to the Report and Order #20777 would then strengthen the bond between the Amateur Radio manufacturer and the individual Amateur Radio hobbyist with the FCC.

Last, but not least, we must conclude by saying that this grandfather clause would be a positive move in the public's interest, convenience, and necessity.

Respectfully submitted,

Dennis Had
Edward Clegg
George Perrine
Marvin Druskoff
EXECUTIVE COMMITTEE
for ARMA

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

In the Matter of

Petition for Rule Making RM-2839
Comments

To: The Commission

ENDORSEMENT OF RM-2839

The Amateur Radio Manufacturer's Association (ARMA) was formed on January 7, 1977, at a general meeting of all manufacturing interests attending the SAROC Convention in Las Vegas, Nevada. The organization is a self-governing body formed in order to encourage high standards and ethics in the Amateur Radio Industry. The basis and purpose of ARMA is to promote the general growth and welfare of amateur radio and to work toward favorable rule making and legislation for the benefit of the industry, as well as to function as a liaison between the member firms and the Federal Communications Commission (FCC). ARMA is also intended to collect and to disseminate market information to the members.

The members of ARMA have studied, with more than a little interest, RM-2839, and find ourselves in agreement with many of the proposals contained therein. We find also, as a representative group, that we have developed a feasible alternative solution to the portion of the ruling involving Type-Acceptance and/or elimination of amplifier equipment in the 24-35 MHz range. We feel that a major change is necessary in this one area.

The organization submits that the legality of licensing retail dealers and/or distributors is not within the jurisdiction of the Federal Communications Commission and, in our opinion, another solution is possible. We propose to the Commission, therefore, this avenue which would enable the FCC to enforce point-of-sale restrictions on *all* parties concerned, whether it be manufacturer or importer, distributor, retailer, consumer, or consumer reseller.

In brief form, for your convenience, we propose that the following data encompasses a viable system:

1) All manufacturers/importers of amateur radio rf generating devices would be required to serial number each and every unit produced and to include a Buyers' Affidavit. The manufacturer would record, in his files, a cross reference of serial number and purchaser data.

2) The Distributor-Wholesaler-Retailer who sells products in the amateur classification would be required to visually inspect a valid Amateur Radio Operator's License (xerox copy acceptable) and to present the buyer with the multi-copy affidavit. The seller would serve as witness to both the transaction and to the actual signing of the affidavit.

3a) The affidavit itself would require the following information: type of product, serial number, call letters of the licensed purchaser, full name and address of the purchaser, and a signed statement of intent that the equipment is for personal use on the frequencies for which the purchaser is so licensed and that he accepts the responsibility for the subsequent use of the equipment upon resale to an individual or group.

3b) Willful violation of any or all of the above stipulations would result in a $1,000.00 penalty fee per occurrence to be levied upon the buyer, dealer, manufacturer, or other party who is responsible in each case.

4) The system would also provide for comparable requirements for mail-order situations. The purchaser would be required to forward the necessary forms and also identification in completed manner prior to the actual delivery of the product.

5) The multi-copy affidavit would be distributed after completion by the purchaser in the following manner: one copy each to the buyer, the dealer, the manufacturer, and the FCC.

We envision this procedure as a more perfectly legal recourse for the FCC to pursue in order to halt the proliferation of illegal CB/pseudo-Amateur products currently on the market. And along these same lines, ARMA feels that the manufacturers should be required to file a separate affidavit supplying the FCC with direct serial number-product description-distribution information.

This alternative proposal, as we see it, offers a path of action with fewer loopholes than the Type-Acceptance route which might well require the elimination of the 24-35 MHz range.

The Amateur Radio Manufacturer's Association remains in total agreement, then, with the FCC's aim to eliminate the illegal use of amplifiers and related equipment. However, we feel that Type-Acceptance in itself is actually an "overkill" and would adversely affect the amateur radio operators as well as the industry itself. Such a limitation would stunt the inventive contributions so often available because of the technical knowledge in the amateur radio world. Our proposed joint effort would form a solid alternative solution which would benefit all parties concerned and would not require more "red tape" or additional enforcement staff at the Federal Communications level.

Respectfully submitted,

Dennis Had
Edward Clegg
George Perrine
Marvin Druskoff
EXECUTIVE COMMITTEE
for ARMA

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554
Docket No. 21135

In the matter of

The simplification of the licensing and callsign assignment systems for stations in the Amateur Radio Service.

NOTICE OF PROPOSED RULE MAKING

Adopted: March 2, 1977;
Released: March 11, 1977
By the Commission: Chairman Wiley concurring in the result.

1. In accordance with the Administrative Procedure Act, 5 U.S.C. 553, and Section 1.412 of the Commission's Rules, 47 C.F.R. §1.412, the Commission hereby gives Notice of Proposed Rule Making in the above-captioned matter.

2. During the past two years there has been an unprecedented explosion in interest in personal radio communications in the United States. The popularity of the CB Radio Service has mushroomed to the point where there are now 8.5 million CB licensees, representing an estimated 20 million users of the CB Service. As recently as February, 1975, there were only 1.1 million CB licensees. The Amateur Radio Service has also grown substantially. Although the population of the Amateur Service had remained fundamentally static for several years, the number of licensees has begun to rise, and the number of newcomers to the Service, those obtaining Novice Class operator licenses, has shown particular growth. In December, 1976, for example, there were 36,000 Novice Class licenses outstanding, while in December, 1974, 21,000 operators held Novice Class licenses. The overall population of the Amateur Service is now approximately 293,000. Two years ago it was 255,000.

3. This surge in interest in personal radio commmunications has placed a heavy burden on those members of the Commission's staff engaged in the processing and issuance of licenses for personal radio communications. Although the workload imposed upon the Commission's staff at our Gettysburg, Pennsylvania, license processing facility has increased approximately 1000 per cent over the past two years, the number of permanent staff employees at Gettysburg has increased by only 50%. This has led, in turn, to an increase in the length of time necessary to process and issue Amateur Radio Service and CB Radio Service licenses. Although temporary permit procedures in the Amateur and CB Services allow, in some instances, operation pending issuance of a license, we are very much aware that many amateur radio licensees are dissatisfied with the speed with which their regular licenses are processed and issued, and we are investigating methods by which, assuming no new resources to be forthcoming, service to our amateur licensees might be further improved.

4. The Rules governing the Amateur Radio Service contain licensing and callsign assignment systems of some complexity. At the time these rules were adopted, the size and workload of our Gettysburg staff were such that routine and special amateur application processing could be accomplished without undue delay. As we indicated in the preceding paragraph, however, our resources have not kept pace with the increased demand for personal radio communications. Given these limited resources, we have been forced to assign priorities to our current licensing activities. *We believe our most important task in the Amateur Radio Service to be the processing and issuance of amateur operator and primary station licenses.* We have reached the point at which our lack of resources simply precludes all but the most basic licensing functions. Our regulatory obligations have outstripped our current capabilities. See paragraph 8, *infra*.

5. During most of the boom in personal radio communications, the Commission has been engaged in a program to deregulate the Amateur Radio Service. The proposals and amendments adopted during this period have been intended largely to simplify the licensing and operation of stations in the Amateur Service, and to that extent they complement our desire to improve our procedures in processing and issuing amateur licenses. They have also been intended, at least in part, to reduce the Commission's workload, whenever such a reduction is consistent with the Commission's regulatory obligations. For example, in a Notice of Inquiry and Notice of Proposed Rule Making in Docket 21033, released January 6, 1977 (42 FR 2089), we proposed, *inter alia*, to eliminate from Part 97 of the Rules repeater stations, auxiliary link stations, and control stations. Under the terms of our proposal in Docket 21033, the functions of such stations could be conducted by other amateur radio stations without prior Commission authorization. If adopted, our proposals in that proceeding would afford amateur licensees much greater flexibility in their operations and would also result in a considerable reduction in the workload of the Commission's amateur radio processing staff. Such a workload reduction would, in turn, enable us to redistribute our resources and provide our amateur licensees with better service in other, more vital, areas.

6. We believe the concepts underlying the proposals in Docket 21033 are sound

and may logically be extended to several other aspects of station licensing and operation in the Amateur Radio Service. We are by this Notice proposing revisions of Part 97 of the Rules which, if adopted, would result in a significant simplification of the licensing structure of the Amateur Service and of Part 97 itself.

7. Under the existing amateur radio licensing system, a licensee must obtain both an operator license and a station license. A licensee holds only one operator license and is required by Section 97.40 of the Rules to have, at a minimum, a primary station license, as well. There are several other station licenses available, however, including military recreation, club, special event, Radio Amateur Civil Emergency Service (RACES), and secondary station licenses, and many amateur operators have obtained one or more (occasionally, many more) such licenses. Additionally, many amateur radio operators are eligible for specific station callsigns or callsigns based on particular "preferred" formats.

8. We do not believe that the continuation of the issuance of the various station licenses, other than primary station licenses, listed above or the existence of the current callsign assignment system to be essential to the Amateur Service. The entire system has become extraordinarily burdensome and difficult to administer properly: A disproportionate percentage of our resources must, because of existing rules, be devoted to the processing of special callsign requests and non-primary station license applications. Processing of primary station license applications and operator license applications suffers as a result. For example, as of January 31, 1977, approximately 308,000 stations were licensed in the Amateur Radio Service. Of these, about 95% were primary stations. The other 5% were secondary stations, club stations, military recreation stations, and RACES stations. Yet processing applications for these non-primary stations required resources nearly equal to the resources needed to process primary station license applications. Similarly, Amateur Extra Class licensees comprise only 6% of the amateur population, but processing specific callsign requests from such licensees requires as much (if not more) time as issuing callsigns to the remaining 94%. Clearly, our resources are not allocated in the most effective manner.

9. In this proceeding we are proposing to simplify the basic licensing structure of the Amateur Service by discontinuing the issuance of all amateur station licenses, other than primary station licenses and space station licenses. (Space stations are under consideration in Docket 19852, Notice of Inquiry adopted October 25, 1973, and we are not proposing their deletion.) All amateur radio operators would be limited to one station license. Specifically, we propose to delete from Part 97 of the Rules military recreation stations, club stations, RACES stations (but not RACES itself), and all additional stations, including secondary stations and special event stations. (As we indicated above, we have already proposed in Docket 21033 to eliminate repeater, auxiliary link, and control stations.) Licensees holding the types of station licenses listed above would be permitted to retain them until expiration of the licenses but would not be permitted to renew them.

10. We recognize that the proposals contained in the preceding paragraph would, if adopted, have an impact on certain groups and individuals. We believe, however, that any such impact would be relatively minor and that the Commission and its licensees would realize significant benefits in the long run from the deletion of the station types in question, including the more efficient issuance of operator and primary station licenses. With respect to the specific station types we are proposing to eliminate and the probable effects of their elimination, we would make the following observations:

a. *Repeater stations, auxiliary link stations, and control stations.* Our proposals concerning these stations are fully explained in our Notice of Inquiry and Notice of Proposed Rule Making in Docket 21033, FCC 76-1198, 42 FR 2089 (1977). Basically, the functions now conducted by such stations would be permitted all remaining amateur stations without separate Commission authorization. No one would appear to be adversely affected by adoption of this proposal.

b. *Military recreation stations.* At the end of 1976 there were only 425 licensed military recreation stations, which are amateur stations licensed to the person-in-charge, often a non-amateur, of a land location at which an amateur station has been provided for the use of operators under the auspices of the United States armed forces. We are aware of no need for continuing the separate licensing of such stations. Those amateur operators wishing to operate such stations may do so by operating portable under their own individual station authorizations. We note that one possible disadvantage to portable operation, the requirement that transmissions from stations in portable operation be distinctively identified, was eliminated by the Commission's Report and Order in Docket 20686, 61 F.C.C. 2d 337 (1976).

c. *Club stations.* There are presently 4,600 licensed club stations. Although the elimination of separate club station licenses would have an impact on certain amateur operating programs and traditions, we believe separate licensing of such stations, which may be held by a club comprised of as few as two persons, to be non-essential. Operations now conducted by club stations may be conducted either by club members operating their stations portable or by club members acting as control operators of another club member's station. We are, however, particularly interested in receiving comments concerning the continued usefulness to the amateur community of separately licensing club stations.

d. *Secondary stations.* A secondary station is a separate station licensed to be an individual amateur operator for a location other than the primary station location. Typically, such stations have been licensed for vacation homes or offices. We believe there to be no need to continue to issue authorizations for secondary stations, because, as we noted in paragraph 10(b), *supra*, amateurs may, under the rule amendments adopted in Docket 20686, operate their primary stations at portable and mobile locations without the previous inconvenience of distinctively identifying their transmissions or providing the Commission with advance notification of extended portable or mobile operation. Further, since the suspension of all licensing fees by the Commission, effective January 1, 1977, we have been receiving multiple — and in many instances, frivolous — applications for secondary station licenses from individual amateurs. The applications for secondary station licenses we have received since January 1, 1977, are already beginning to burden our processing staff, and we anticipate a flood of new secondary station license applications as soon as this Notice of Proposed Rule Making is released to the public. For this reason, and to enable the continued efficient processing of other amateur radio license applications, we are hereby declaring, effective with the release of the News Release announcing adoption of this document, a "closed season" on the filing of applications for new secondary stations or special event stations (see below). All applications for new secondary stations received on or after the effective date of the closed season will be returned. Applications for renewal or modification of existing secondary station licenses will continue to be accepted, however. The closed season on filing applications for special event and new secondary station licenses will continue until Commission policy in this area is determined.

e. *Special event stations.* Special event stations are licensed for temporary use in connection with the celebration of an event of either general interest to the public or of particular interest to amateur radio operators, and are intended to bring favorable public attention to the Amateur Radio Service. In 1976 approximately 100 special event stations were licensed. Special event stations are assigned distinctive, unusual callsigns, and it frequently appears that such stations are used not so much to celebrate special events as to enable amateur operation with "exotic" callsigns. We solicit comments concerning the continued usefulness, if any, of special event stations and wish to be provided with specific, concrete examples of special event stations that have brought favorable public attention to the Amateur Radio Service. For reasons outlined above, we are including special event stations in the closed season on the submission of station license applications.

f. *RACES stations.* Radio Amateur Civil Emergency Service stations are stations licensed to civil defense organizations to provide the facilities for amateur radio operators to conduct communications in RACES. Such stations are assigned distinctive callsigns prefixed by the letters "WC". Such stations must in all instances be operated by licensed amateur radio operators, and for this reason we believe such operation can be conducted by amateur operators under their individual station licenses. Functions now conducted by RACES stations and amateur stations participating in RACES would be combined in a form of amateur operation known as "RACES operation." Under this proposal, there would be no change in the basis and purpose of RACES itself, and we believe RACES operations would not be seriously affected if our proposal is ultimately adopted. We do wish to receive comments addressing the utility of separately licensed RACES stations, however.

Deletion of the types of amateur stations listed above would have the added advantage of enabling us to delete the FCC Form 610-B, Application for Amateur Club, Military Recreation, or Radio Amateur Civil Emergency Service Station license.

11. We are also proposing in this proceeding to simplify drastically the system of amateur radio callsign assignment. Under Section 2.302 of the Rules, the Amateur Radio Service is allocated certain blocks of callsigns. Sections 97.51 and 97.53 of the Rules contain rather complex regulations and policies governing amateur radio callsign assignment. Certain licensees are eligible for "1x2" callsigns (callsigns consisting of one letter, one digit, and two letters), others are eligible for certain non-specific "preferred" callsigns, while still others must take the callsigns assigned them by the Commission. We believe there to be no compelling need to continue the complex system of callsign assignment that now exists, a system which, as we indicated heretofore, occupies an inordinate amount of our staff's time, and we are proposing, accordingly, to amend Section 97.51 of the Rules to state simply that amateur radio callsigns will be assigned on a systematic basis. Section 97.53 of the Rules would be deleted entirely. Licensees holding Amateur Extra Class operator licenses would be afforded the opportunity to obtain 1x2 and 2x2 callsigns, but such callsigns would be assigned systematically by the Commission. (Amateur Extra Class licensees would not be permitted, as they are now, to obtain specific 1x2 callsigns of their choice.) Licensees moving from one callsign area to another and modifying their licenses to reflect the moves would not continue to be assigned new callsigns of the same format as the callsigns relinquished. Nor would we continue to issue specific callsigns to former holders thereof. We would not issue any more distinctive callsigns to stations in repeater or RACES operation.[1] Our proposal, if adopted, would result in a much simpler and fairer callsign assignment system and would permit us to concentrate our limited resources in areas more productive for the Amateur Radio Service.

12. The specific rule amendments we are proposing are set forth in the attached Appendix. Authority for these proposals and for the "closed season" announced herein is contained in Sections 4(i), 5(e), and 303 of the Communications Act of 1934, as amended. We invite interested parties to submit comments concerning our proposals on or before June 2, 1977, and reply comments on or before June 30, 1977. An original and five copies of all comments and reply comments shall be furnished the Commission, pursuant to Section 1.419 of the Rules. Respondents wishing each Commissioner to have a personal copy of the comments may submit an additional six copies. Members of the public wishing to express interest in our proposals but unable to provide the required copies may participate informally by submitting one copy of their comments, without regard to form, provided the correct docket number is specified in the heading of the comments. All comments and reply comments filed in this proceeding should be sent to the Secretary, Federal Communications Commission, Washington DC 20554.

13. Individuals wishing to inspect the comments and reply comments filed in this proceeding may do so during regular business hours, 8:00 am to 4:30 pm Monday through Friday, in the Commission's Public Reference Room, 1919 "M" Street, N.W., Washington DC 20554.

FEDERAL COMMUNICATIONS COMMISSION
Vincent J. Mullins
Secretary

APPENDIX

Parts 1 and 97 of Chapter 1 of Title 47 of the Code of Federal Regulations are proposed to be amended, as follows:

§1.922 [Amended]

1. In §1.922, FCC Form 610-B is deleted.

2. In §1.926, paragraph (b)(4) is deleted and designated [Reserved], and paragraph (b)(1) is amended, as follows:

§1.926 *Application for renewal of li-*[illegible].

(b)(1) Applications for renewal of an amateur operator license, an amateur station license, or a combined amateur operator/station license, shall be filed on FCC Form 610.

(4) [Reserved].

3. §1.951(a) is amended to read as follows:

§1.951 *How applications are distributed.*

(a) Personal Radio Division: Amateur, Disaster, and Personal

4. §1.952 is amended to read, as follows:

§1.952 *How file numbers are assigned.*

(b) File number symbols and service or class of station designators:

Amateur and Disaster Services

Y — Amateur

D — Disaster

5. §1.1115 is amended to read, as follows:

§1.1115 *Schedule of fees for the Safety and Special Radio Services.*

(a) * * *

Amateur Service

Modification of license without renewal . . . [illegible]

(b) * * *

(c) * * *

(6) Application for Interim Amateur Permits or Novice Class licenses in the Amateur Radio Service.

6. In §97.3, paragraphs (f), (g), (h), and (i)

[1] We are aware that in Docket 21033 we proposed to continue in certain instances to issue distinctive callsigns to stations in repeater operation and that our proposal in this proceeding to eliminate such callsigns entirely is, to that extent, inconsistent.

are deleted, paragraphs (j) through (y), inclusive, are redesignated paragraphs (f) through (u), respectively, and paragraphs (c) and (d) are amended to read, as follows:

§97.3 Definitions

(c) *Amateur radio operator*. A person holding a valid license to operate an amateur radio station issued by the Federal Communications Commission.

(d) *Amateur radio license*. The instrument of authorization issued by the Federal Communications Commission consisting of a station license and an operator license.

Operator license. The instrument of authorization including the class of operator privileges.

Station license. The instrument of authorization for a radio station in the Amateur Radio Service.

Interim Amateur Permit. A temporary operator and station authorization issued to licensees successfully completing Commission supervised examinations for higher class operator licenses.

7. In §97.37, the headnote and text are amended to read, as follows:

§97.37 *Eligibility for station license*.

(a) An amateur radio station license shall be issued only to a licensed amateur radio operator.

(b) An amateur radio station license shall not be issued to a school, club, company, corporation, association, or other organization.

(c) An amateur radio operator shall be issued no more than one amateur radio station license. (This paragraph does not apply to an amateur radio operator applying for a space radio station license.)

§97.39 [Deleted]

8. §97.39 is deleted.

9. §97.40 is deleted and redesignated §97.39, paragraphs (c), (d), and (e) are deleted, and paragraph (b) is amended to read, as follows:

§97.39 *Station license required*.

(b) Every amateur radio operator shall have an amateur radio station license.

10. In §97.41, paragraphs (b), (c), and (d) are deleted, paragraphs (e), (f), and (g) are redesignated paragraphs (b), (c), and (d) respectively, and paragraphs (a) and (b) are amended, as follows:

§97.41 *Application for station license*.

(a) Each application for an amateur radio station license shall be made on FCC Form 610.

(b) If the application is for a station license, only, it shall be submitted to the Federal Communications Commission, Box 1020, Gettysburg, Pennsylvania, 17325.

11. §97.47 is revised to read, as follows:

§97.47 *Renewal and/or modification of amateur station license*.

(a) Application for renewal and/or modification of a station license shall be submitted on FCC Form 610. In every case the application shall be accompanied by the applicant's license or a photocopy thereof. Applications for renewal of unexpired license must be made during the license term and should be filed not later than 90 days prior to the end of the license term. In any case in which the licensee has, in accordance with the provisions of this chapter, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(b) If a license is allowed to expire, application for renewal may be made during a period of grace of one year after the expiration date of the license. During this one year period, a license is not valid. A license renewed during this one year period will be dated currently and will not be backdated to the date of expiration.

(c) When the name of a licensee is changed, or when the mailing address is changed (without changing the authorized location of the amateur radio station) a formal application for modification of license is not required. The licensee shall notify the Commission promptly of these changes, however. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in Commission records, the new name and/or address, as the case may be, and the callsign and class of operator license. The notice shall be sent to the Commission, Gettysburg, Pennsylvania 17325, and a copy shall be maintained with the license of each station until a new license is issued.

12. In §97.51, paragraph (a) is amended, paragraph (b) is redesignated paragraph (d), and new paragraphs (b) and (c) are added, as follows:

§97.51 Assignment of callsigns.

(a) The callsign of an amateur radio station shall be assigned by the Commission on a systematic basis.

(b) An Amateur Extra Class operator may obtain on request, subject to availability, a station callsign consisting of one letter followed by one digit followed by two letters, or a callsign consisting of two letters followed by one digit followed by two letters. Callsigns assigned under this paragraph shall be assigned by the Commission on a systematic basis. No request for a specific callsign or callsign format shall be granted.

(c) No request for a specific callsign or callsign format shall be granted.

(d) * * *

§97.53 [Deleted].

13. §97.53 is deleted.

14. §97.87(b) is amended to read, as follows:

§97.87 Station identification.

(b) If the control operator of a station is not the station licensee, the station identification required by this section shall be the callsign assigned that station. If a station is operated on frequencies authorized by §97.7 for use by the control operator but not authorized for use by the station licensee, the required station identification shall be the callsign of that station followed by the station callsign of the control operator (e.g., WB6XYZ/W6XY).

15. §97.95(a)(1) and (a)(2) are amended to read as follows:

§97.95 *Operation away from the authorized fixed operation station location*.

(a) * * *

(1) When there is no change in the authorized fixed operation station location, an amateur radio station may be operated under its station license anywhere in the United States, its territories or possessions, as a portable or mobile operation, subject to §97.61.

(2) When the authorized permanent station location is changed, formal application (FCC Form 610) must be submitted to the Commission prior to any operation and within 4 months of the move for the purpose of modifying the station license to show the new permanent station location. Operation at the new location is permitted under the license for the former station from the date the modification application is mailed until the applicant is advised of Commission action on that application.

16. §97.103(b)(1) is amended to read as follows:

§97.103 *Station log requirements*.

(b) * * *

(1) The date and time periods the duty control operator for the station was other than the station licensees, and the signature and station callsign of that duty control operator.

17. §97.112(b) is amended, as follows:

§97.112 *No remuneration for use of station*.

(b) Control operators of an amateur station may be compensated when the station is operated primarily for the purpose of conducting amateur radiocommunication to provide telegraphy practice transmissions for persons learning or improving proficiency in the international Morse code, or to disseminate information bulletins consisting solely of subject matter of direct interest to amateur radio operators, provided:

18. §97.163(b) is amended to read, as follows:

§97.163 *Definitions*.

(b) *RACES operation*. Amateur radiocommunication conducted by amateur radio stations in the Radio Amateur Civil Emergency Service.

19. §97.165 is amended to read, as follows:

§97.165 *Applicability of rules*.

In all cases not specifically covered by this Subpart, amateur radio stations engaging in RACES operation shall be governed by the provisions of the rules governing amateur radio stations and operators (Subparts A and E of this Part).

20. §97.169 is amended to read, as follows:

§97.169 *Station license required*.

No station shall engage in RACES operation unless the station is an amateur radio station licensed by the Federal Communications Commission and is certified by a responsible civil defense organization as being registered with that organization.

§97.171 [Deleted]

21. §97.171 is deleted.

§97.173 [Deleted]

22. §97.173 is deleted.

§97.175 [Deleted]

23. §97.175 is deleted.

24. §97.177 is amended to read, as follows:

§97.177 *Operator requirements*.

No person shall be the control operator of an amateur radio station engaging in RACES operation unless that person holds a valid amateur radio operator license issued by the Federal Communications Commission and is certified by a responsible civil defense organization as being registered with that organization.

25. §97.181 is deleted and a new §97.181 added, as follows:

§97.181 *Station identification*.

In addition to the station identification requirements of §97.87, each amateur radio station engaging in RACES operation shall transmit the following additional information: When identifying by radiotelephony, a station in RACES operation shall transmit the word "RACES" at the end of the station callsign. When identifying by radiotelegraphy, a station in RACES operation shall transmit the fraction bar DN followed by the letters "C" or "CD" at the end of the station callsign.

26. §97.185(b) is amended to read, as follows:

§97.185 *Frequencies available*.

(b) In the event of any emergency which necessitates the invoking of the President's War Emergency Powers under the provisions of Section 606 of the Communications Act of 1934, as amended, unless modified or otherwise directed, amateur radio stations engaging in RACES operation will be limited in operation to the following frequencies:

27. §97.189 is amended to read, as follows:

§97.189 *Points of communication*.

Amateur radio stations engaging in RACES operation may be used only to communicate with the following, upon authorization of the responsible civil defense official for the organization in which the amateur radio station is registered:

(a) Amateur radio stations registered with the same or another civil defense organization;

(b) Stations in the Disaster Communications Service;

(c) Stations of the United States government authorized by a responsible agency to exchange communications with stations engaging in RACES operation; and

(d) Any other station in any other service regulated by the Federal Communications Commission, whenever such station is authorized by the Commission to exchange communications with stations engaging in RACES operation.

28. In §97.193, the headnote is revised and the text amended, as follows:

§97.193 *Limitations on the use of stations operating in RACES*.

All messages which are transmitted in connection with drills or tests in RACES shall be clearly identified as such by the use of the words "drill" or "test," as appropriate, in the body of the messages.

WESTERN PENNSYLVANIA REPEATER COUNCIL

In the Matter of

Deregulation of Part 97 of the Commission's Rules to simplify the licensing and operation of complex systems of Amateur Radio stations and modification of repeater subbands.

Docket No. 21033

Response and Comments

March 17, 1977

by the Western Pennsylvania Repeater Council

The following response and comments to the docket in question are made in cooperation with a committee of members from the Western Pennsylvania Repeater Council. The contents of this response are approved by the total membership of the council (at this time, thirty-eight trustees).

The council agrees with the general intent of Docket No. 21033, but feels that the extent of the deregulation exhibited by this docket is such that it will be abused. We feel that deregulation without structure is not good. The complete relaxation of repeater subbands would create chaos on all bands and make the voluntary jobs of the frequency coordinators or repeater councils one which would be excruciating. We do realize that amateurs have been, by and large, self-regulating, but there is always that one fanatic who goes to extremes when interpreting rules or the lack thereof and will create havoc on the bands. We feel that structured deregulation is necessary.

To be more specific:

Referring to paragraph six of the docket, we feel that there is a definite need to license repeaters separately from those of auxiliary, control, or remotely controlled stations. Deregulation would permit any amateur to put a repeater on the air without prior exhibition of technical competence which your licensing procedure now requires. The other alternative would be to require the amateur wishing to place a repeater on the air to prove his technical competence and receive a frequency from a recognized area council. Furthermore, delete the word repeater from the following statement and have it read: All amateur station licenses would convey authority to operate as control, auxiliary, link, and remotely controlled stations.

Referring to paragraph seven of the docket, we agree with the wording.

Referring to paragraph eight of the docket, we again state that repeaters should be licensed as a separate entity and therefore should be given a distinctive "WR" callsign.

We therefore disagree with the need for the suffix or prefix "R" or "RPT" or the word "REPEATER," but do see the need in auxiliary operation for a descriptive term.

Also referring to paragraph nine of the docket, the council does not care what length of time should be required for station identification. Trustees of repeaters would set their identification interval at any sequence that they deemed sufficient to let the users know what repeater they are working, up to the maximum allowable time anyway.

We agree with paragraph ten and would like to make an additional comment. We feel that deregulation could be extended to the point of eliminating the control operator and making the individual amateurs using the repeater responsible for their actions and words while using the repeater.

We also agree with paragraph eleven.

Referring to paragraph twelve of the docket, the council totally disagrees with removal of repeater subbands as stated in a previous paragraph of this response. We further wish to state that repeater subbands should not interfere with other modes of operation within the same frequency band. We feel that there is no place for repeaters below ten meters and that they should be assigned to specific blocks of frequencies only on or above ten meters. We do, however, agree that monitoring of the frequency used for auxiliary operation before and during operation is necessary and in accordance with good operating practice.

Concerning the request for comments

about power limitations, we feel that these limitations should be continued. The basic concept of repeaters was to provide intra-community communications, and a limit on the amount of power accomplishes this perspective. We do suggest a modification of the power limitation rule as it now reads, and that is to reword it to the effect of measuring power at the base of the antenna (at the antenna end of the feedline) and not the theoretical value required by calculating effective radiated power.

Frequency coordinators or area councils (if they handle frequency coordination) must be given additional power to meet anticipated congestion due to the growing number of repeaters. A mandatory requirement of every group or individual wishing to place a repeater on the air should first be to secure a frequency from a coordinator or council. It should be additionally noted that giving the coordinators or councils official power is not a far-fetched idea or just a whim — the Commission refers frequency coordination for the commercial services to an outside firm.

Respectfully submitted,

Daniel H. Rabinovitz K3ISO
Secretary, WPRC

TO:
THE FEDERAL COMMUNICATIONS COMMISSION
Washington DC 20554

COMMENTS OF:
Thomas M. Gooding
206 West Maple Avenue
Sterling VA 22170
Licensee of ARS K4LHB and WR4ABR

IN THE MATTER OF: Docket No. 21033. Notice of Inquiry and Notice of Proposed Rule Making Adopted December 22, 1976.

TITLED: Deregulation of Part 97 of the Commission's rules to simplify the licensing and operation of complex systems of Amateur Radio stations and modification of repeater subbands.

1. The following comments are based on my experience of nearly twenty years as an amateur licensee with emphasis on activity in the VHF region. I am trustee for the Northern Virginia FM Association, Inc., for the repeater license WR4ABR and have served since 1970 as an officer and director of that organization.

2. It would appear that the effort to deregulate the Amateur Service is beginning to exceed prudent restraint. While much deregulation is possible without changing the basic principles and traditions of the Service, caution is necessary to preserve those traditions which have made the Amateur Service and the hobby it regulates so valuable to the public interest. I urge the Commission to take a hard look at the disruption that this and subsequent proposals may cause to the overall service and to consider that some restraint in deregulation is necessary.

3. I agree with the proposal to delete the requirement to separately authorize control, auxiliary link, and other remotely controlled stations, including repeater stations. Since it is no longer necessary to submit to the Commission technical showings to obtain a repeater license, it is only logical to make these types of operation an inherent privilege of a primary or club station license. The addition of "/R" or "/RPT" is quite sufficient to identify this activity.

4. It is still necessary to limit the repeater activity to specific subbands, however. Except for isolated cases, the amateur-administered program of frequency coordination has worked well. This program is based on band plans which are formulated on specific subband assignments for repeaters. The continuous use of a particular frequency by a repeater could give an unfair advantage to the repeater station over non-repeater stations, should all frequencies be available for repeater operation.

5. An expansion of the present allocations is certainly appropriate, however. I do believe that the nature of the VHF repeater vs. the propagation vagaries and lack of traditional channelization makes the MF and HF bands a poor choice to even attempt repeater operation. Therefore, I recommend that repeater operation be limited to frequencies above 29.0 MHz and that present repeater allocations be expanded as follows:

29.0	to	29.7 MHz
*145.0	to	148.0 MHz
221.0	to	224.0 MHz
**420.0	to	431.0 MHz
**437.0	to	450.0 MHz

The expansion of the 146-148 MHz band to the limits above (*) *must* be predicated on the expansion of the privileges of the Technician Class licensee to include the band 144 to 145 MHz. This is vital to preserve the non-repeater operation and non-FM activity now in the frequency band 145 to 146 MHz. This move would consolidate the weak signal activity to just above 144 MHz.

It is also necessary to protect the weak signal and Amateur Television activity in the band 431 to 437 MHz (**). The Commission may also wish to protect the satellite activity in the 10, 2, and 3/4 meter bands.

6. I concur in the proposed deletion of the recording requirement of automatic control (§97.111(g)(2)) and agree that satisfactory rules compliance is practical within the provisions of proposed §97.85(e). However, §97.88(e) should be modified to permit radio control via the repeater receiving frequency as a secondary system to the control facility provided by wire-line or other radio frequencies. This would greatly increase the potential for prompt exercise of the control function from portable and mobile units, particularly when the station is being operated under automatic control. It is important that this uplink control be only secondary and cannot relieve the station of maintaining positive control as now set forth in the rules.

7. After noting it in paragraph 3 of the Docket 21033 Notice, the Commission omitted any further reference to the petitioner's request in RM-2780 to delete the requirement for noting third party traffic in the station log (§97.103(b)(2)). The same reasons that make logging under automatic control unnecessary also make this logging requirement unnecessary. The licensee has the option not to initiate or to terminate third party traffic which is contrary to the regulations.

8. Since only isolated cases of significant problems have occurred in the area of frequency coordination, I urge the Commission to make *no* particular statement on repeater frequency assignment. It might be wise to permit the Commission to officially arbitrate disagreements between individual repeater stations where they can show that they are unable to reconcile their differences in any other way. The proposed §97.63 is probably sufficient if any regulation is needed at all. At no time should the Commission designate non-Commission personnel to administer a frequency allocation program. This is best handled by the ARRL or similar groups of Amateurs.

9. I would endorse the provision in proposed §97.84(c) to permit up to 10 minute intervals between required transmission of repeater station indentifications.

Thomas M. Gooding K4LHB

Ham Help

I am at present preparing for the Extra exam and would like a little information. I am a subscriber to *73 Magazine* and enjoy it very much. Also have the *73 Extra Class License Study Guide*, and *73* 20 wpm tape, all of which I find very helpful. However, do you know of any CW magazine that I can subscribe to? By that I mean any magazine devoted exclusively to CW. I thought I read about one in the March issue of *73*, but am unable to locate the article. Thank you for your kind attention to this inquiry.

Frank Travick
2140 Indian Lake Road
Niles MI 49120

I have two pieces of gear that might be salvaged, but no schematics. One is an HP 524B frequency counter, with a 525A scaler. The basic counter is inoperative. Also, I have a Poly-Comm 62 transceiver for 6 and 2 meters AM. Again, no schematic. I would be willing to reimburse any reader for info on the above units.

I am on Social Security disability, and this is the only way I can get on the air within my budget. Anything you can do would be greatly appreciated.

John P. Dieringer W6RVP
9010 Ramsgate Ave.
W. Los Angeles CA 90045

I am very interested in becoming a ham operator. I started reading your fine magazine 3 months ago in my high school library. I eagerly await each new issue so I can check out last month's magazine and I can study it more closely. I really like your columns, and especially your radio construction projects for beginners. I also think your "Ham Help" column is a terrific public service!

Several of my friends and I want to move up into ham radio, but we are having trouble with the code and desperately need help. We would sure appreciate help from anyone in our area. Also, there are many potential hams besides us, and I think a class in amateur radio would go over very well.

Ronald Carnes
PO Box 285
Leitchfield KY 42754

I would like to hear from hams knowledgeable in the solar power field. I want to build nicad chargers, and twelve volt supplies for ham equipment in field use.

I can help those interested in Zepp, random, and other antennas, as well as transmatches and tuners.

James G. Coote WB6AAM/6
6525 Elder St.
Los Angeles CA 90042

Do you know of anyone in the Nuernberg area of Germany who would be willing to help me prepare for my Novice license? I have been interested for a long time and have made many false starts on my own, but need a person to help me with it to succeed.

SP4 Charles W. Espey Jr.
HHB, 1st AD Arty
APO NY 09070

I reside near the Poughkeepsie area in Dutchess County (NY), and would like to take the Novice test. I would appreciate hearing from any ham willing to monitor the test.

F. Cuillo
Box 145
Wassaic NY 12592

I am eleven years old and deeply into amateur radio. I would like to get into a computerized RTTY system on 24 GHz that will send out a signal in microsecond bursts, but I need a transceiver for that frequency that will handle that situation. Can anyone help?

Jim Woodyatt
6646 Mozelle Cir.
Yorba Linda CA 92686

Would like to hear from present owners of the Hallicrafters FPM 200 (not 300) with possibility of forming a club to exchange information of interest.

Jerry Swartzlander W8EPI
PO Box 666
Fremont OH 43420

I am a man 84 years old. I received my Novice license on April 7, 1976, and have had 1 contact so far. I have been off the air for 26 years — had a Technician license for over 20 years, and took sick and while sick my license lapsed. Could you put me in contact with some Novices who need help with the code like I do?

Glenn N. Crawford WBØSLV
207 5th Ave. N.
Humboldt IA 50548

I have a problem I think you can help me with. Over the years, I have picked up a lot of very nice equipment at very reasonable prices. Unfortunately, the I/O code is EBCDIC. Many of the boys are handling this problem with software, but this seems an awful waste of RAM.

There are ROMs available, but the quotes I have received range from $58.00 to $72.50 for single units.

If anyone in your very large readership knows where I can obtain Read Only Memories which convert ASCII to EBCDIC and back for $10.00 or less, would they please let me know?

If I can get my hands on one of these chips, I'll put something together and send you a piece for the I/O section of *73*. There must be a lot of good EBCDIC equipment just gathering dust.

Richard Wright
676 Coe Street
Tiffin OH 44883

P.S. Does this problem remind you of the old 400 cycle power supply problem?

Harrison

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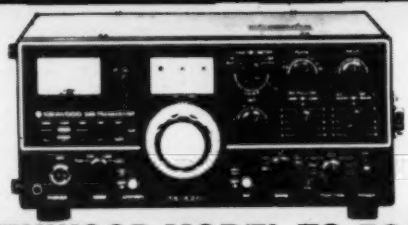

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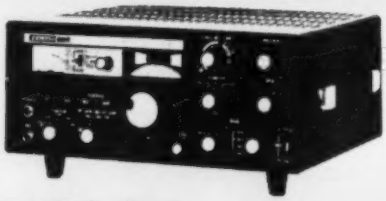

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Looking West

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

ANYONE HAVE A SPARE ICEBERG?

A sky so blue it looks as though it were a painting by one of the masters rather than a creation of Mother Nature herself. In the middle of this blue panorama hangs a sun whose white hot rays bring 80° warmth to this scene daily. Nestled below this sky are the mountains, deserts, woodlands and cities that make up the state I call home: California. Only one problem, though. For all her picturesque creativity in building this scene, Mother Nature has gone a bit awry. You see, one would expect to have this scene from mid-June until the beginning of October. However, it's now April, and with little exception the rains we need to grow our crops and provide water to our cities have yet to come.

We are in pretty bad shape out here. At least that's what the TV and the newspapers tell us. Normally our rainy season, approximately mid-October to early June, would bring the water necessary for the rest of the year. However, this year something went wrong, and while most of the nation froze in sub-zero temperatures that were accompanied by heavy snowfalls, out here on the West Coast it was warm and dry. Now the time has come when it looks as if we are going to have to pay the piper for his nice music. Already, a number of Northern California cities have imposed severe restrictions on the amount of water to be used by each person and for each task. Soon I suspect that we here in the Southland will be forced to follow in the same direction. It's a rather heavy price to pay for a warm winter, but it is something that we have no control over. As I said, the time has come when we must pay the price for this winter, unless one of you out there has a spare iceberg or two lying around and wishes to donate same to a worthy cause. Any takers?

When a voluntary coordinating council such as the SCRA administers an area as large as Southern California, it is obvious that the four people who make up the elected directorate along with the members of the two technical committees cannot be everywhere at once. Problems arise, and it would be nice to know when such "brush fires" ignite, so that they can be solved before they reach the "forest fire" stage (as has happened in the past). Then too, when you issue a "90 Day Test Sanction" for a new system, it would be kind of nice to have someone available from the organization to work with those involved, so that they can more easily interface with existing activity. If such is not possible, it would be nice to at least have someone to turn to with a call for help. The evening before the April 2nd SCRA meeting, Jim Hendershot WA6VQP and myself sat in my living-room pondering just such a problem. It was no secret out here that both Jim and myself were running for elective office within SCRA (Jim for Chairman and I for Vice Chairman), and we wanted to have a few new ideas ready that would enable us to help build even stronger unity within the organization (should it come to pass that one or both of us were elected). The key, we felt, would lie in developing quick lines of intercommunication between us in Los Angeles and the rest of the administrative area. While Jim says it was my idea, I really feel that I must share credit with him for the idea that follows. We call it the "SCRA Area Advisor" — an amateur from each given area recommended to us by his peers who will act as an interface between the people of his area and the SCRA proper. In that way, we felt that any situation that might arise could be handled a lot faster. The fact that such was being dealt with by an area resident rather than a group of "outsiders from the big city" would tend to bring "vibes" of goodwill rather than help fan the flames. We felt that the only proper way to select such people was to let those whom he or she would be working with make the choice, since only in such a way could that person hope to get the support of all amateurs in his or her area.

Both Jim and myself were elected to the offices we were candidates for, along with incumbent Don Root WA6HJW as Secretary and Warren Andreasen WA6JMM as Treasurer. Jim has already opted to reappoint Tom Rutherford W6NUI as 220 MHz Techical Committee Chairman, but as of this moment has yet to pick a leader to handle the same position for two meters. However, we are proud to announce that the first SCRA Area Advisor's position has gone to Paul McClure WA6HGK in San Diego (on the very strong recommendations of that area's representatives present at the meeting). It's only been three days since the meeting, so we are still waiting to hear the recommendations from Santa Barbara, Ventura County, Orange County, the High Desert, and the Low Desert. By next month, we should have the names of those who will be taking on this responsibility for the areas they reside in.

On motions brought from the floor by immediate past Chairman Bob Thornberg WB6JPI, the membership voted to actively seek and implement direct technical committee interface between the SCRA, the Southern California Repeater and Remote Base Association, and the Mexican Coordinating Council, so that each can know what the other is doing and thereby avoid any form of "rf" conflict. The establishment of such an interface only awaits action by these other groups. Fred Deeg K6AEH will be acting as liaison to SCRBBA if all materializes as we hope. A number of people are being considered for the post of Mexican liaison. Again, more on this as it materializes. We also hope to develop direct lines of communication with NARC (the Northern Amateur Relay Council), so that we can work together on any problems common to both organizations. Jim, Don, Warren, and myself have taken on a big responsibility; however, with the help of the technical committees and the overall support of the organization as displayed at the April 2nd meeting, we feel that we can accomplish a lot in building strong repeater and human relations. At least we intend to give it the old "college try."

Special thanks must be given to Bill Carpenter and the JPL Radio Club for the exceptional meeting facilities provided. We met in the Von Karmahn Auditorium at JPL — a place that many of you have viewed on your TV screens during US space missions — and it is, from a technological standpoint, the finest facility that SCRA has access to. There is something special about holding a meeting there, holding a meeting dedicated to the future of amateur relay communication in a place where history was created. A very special feeling of pride.

SUNDAY AND DOCKETS IN THE PARK

21033 ... 21116 ... 21117 ... 21135 ... RM-2844 ... RM2839 ... letters and numbers that hold the future of the amateur service in their collective nomenclature. But, how many hams really know or realize what effect action on any of these will have on his personal amateur career, or on the careers of us collectively. In an effort to educate and motivate interest by area amateurs in just this very thing, a coalition consisting of Alhambra RACES, the Mt. Wilson Repeater Association, and the Amateur Radio Media Workshop sponsored an open format discussion on this topic in Alhambra Park on Sunday, April 3rd. Though hurriedly put together, this meeting was attended by about 70 area amateurs who came to ask questions of such well-known amateurs as Herbert (Pete) Hoover III W6ZH, Bob Thornberg WB6JPI, Lenore Jensen W6NAZ, Al Ogden W6SPK, Don Root WA6HJW, and yours truly. They came because they cared about their own future, and realized that if they were going to air their views on these matters to the Commission, they first had to thoroughly understand exactly what was transpiring in Washington.

They also needed to know what the proper method of filing such responses was, and the intricate why's and wherefore's to include in such responses. They came, they listened to the "experts," they asked questions, and hopefully they went home to file

The panel of experts included (L to R): Don Root WA6HJW, Pete Hoover W6ZH, Chairman Bob Thornberg WB6JPI, Al Ogden W6SPK, and WA6ITF. Not shown: Lenore Jensen W6NAZ. Photo by Chris Williams WB6HGW.

Arriving in style: Pete Hoover W6ZH and XYL with BMW.

Providing audio engineering is the master himself, Bill Orenstein KH6IAF. Photo by Chris Williams WB6HGW.

their own personal views on the pending deregulation and reregulation.

With only two weeks' lead time, it would not have been at all possible to make this a go if it had not been for the efforts of such concerned amateurs as Paul Wirt W6AOP (who procured the meeting site), the ever present and ever available Bill Orenstein KH6IAF (along with his fine Shure Vocal-Master PA system), Orlo Brown K6SUJ (who obtained free use of the dias table and seating), Bob Thornberg (who doubled as event organizer and meeting chairman), and many many others who realized the necessity to both "educate and motivate" amateurs. Although quickly planned, for those in attendance (including a contingent from the SANDRA organization who mobiled up from San Diego, and a duo who flew their Cessna 182 in from up north) it was indeed a success. If they each file a response, it will have been even more of one.

JACK ANDERSON VS. AMATEUR RADIO

Last month I was pretty hard on the ARRL for their failure to act and assume responsibility for the creation of a National Voluntary Band Planning Council. It's now April 5th, and to date I have yet to hear of any positive action in that direction coming from Newington — nor do I expect to hear any in the near future. On this one I hope that I am proven wrong. Come on ARRL, how about surprising us with some positive and quick action on this one!

Now, however, comes an attack upon the ARRL, the FCC and the very structure of the amateur service itself, from none other than the celebrated columnist Jack Anderson. Mr. Anderson writes a widely-read syndicated column for United Feature, 220 East 42nd Street, New York City NY 10067. In this column Mr. Anderson states that in effect it is the amateur service that is holding back the future expansion of the citizens radio service. He goes on to state that from confidential sources and reports, including one prepared for Representative Elliott Levitas of Georgia, he has learned that we amateurs "control" the FCC (ah ... if only that were true), that the ARRL is a "lobby" for amateur radio (we should only be so lucky), and that we amateurs have "a lock" on the higher frequencies which are interference free (whatever that's supposed to mean). He states that hams control more frequencies than all of the nation's police and fire departments, commercial and educational FM broadcast stations, and TV stations in New York and Los Angeles — *combined!* Well I guess that's true if you count some of the stuff up in the GHz region and light, but tell me, how many QSOs have you had with your flashlight lately, fellow hams? Out here if you stand on your roof calling CQ in CW with a flashlight, the response you get will probably be a police helicopter circling above you with a rather bright light of its own, and a number of police officers on the ground who will want to know why you were up there in the first place and exactly what you were doing.

Anderson claims that FCC Chief Ray Spence has made decisions detrimental to CB. I suppose that if one is in a position of having to enforce the Commission's rules he might be placed in such a position from time to time. However, Mr. Anderson fails to mention that it is the Board of Commissioners, and not Mr. Spence, who makes the decisions around the FCC. In Field Operations, Mr. Spence is only doing his duty to his employer — in this case, the Federal Government in the form of the FCC. Since when is it improper to obey the directives of your superiors, Jack? I'd get fired if I did not follow my bosses' directives!

There is more to this story, but by now it should be clear what the whole thing is about: another attack from CB in the hope of grabbing 220 from us. It was a cruel story, one without any real basis in fact and one that we have heard time and time again. However, I find it a bit hard to hold Mr. Anderson totally responsible, in that I doubt if he has any first-hand experience with either service. I suspect that he thought he had a good story and went ahead with it without bothering to check as carefully into the facts as he should have. Unfortunately for him, this is one that just did not pan out as expected. Even more unfortunately for us, though, this column may well have caused irreparable harm. I sincerely hope that when Mr. Anderson learns the true facts, he will follow up with the kind of story that will punch holes big enough to let all the hot air out of those who would act to discredit the amateur service for the sole purpose of the theft of our spectrum. If anyone can do it, Anderson can. Educate him! The ARRL a lobby for ham radio? We should only be so lucky!

Don't forget to write a letter of education to Jack Anderson. If he gets enough input, and it's the right kind, we just might be able to make a friend of amateur radio out of him — rather than have him as an enemy.

Oscar Orbits

Oscar 6 Orbital Information				Oscar 7 Orbital Information			
Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W	Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
NA 21155 BTN	1	0138:29	85.8	11630 BQ	1	0030:49	61.0
N 21167	2	0038:25	70.8	11643 BQ	2	0125:06	74.6
NA 21180 BTN	3	0133:21	84.6	11655 BQ	3	0024:26	59.4
N 21192	4	0033:17	69.6	11668 A	4	0118:43	73.0
NA 21205 BTN	5	0128:12	83.3	11680 B	5	0018:04	57.8
N 21217	6	0028:08	68.3	11693 A	6	0112:21	71.4
NA 21230 BTN	7	0123:04	82.1	11705 B	7	0011:42	56.3
NA 21242 BTN	8	0023:00	67.1	11718 AX	8	0105:59	69.8
N 21255	9	0117:58	80.8	11730 B	9	0005:19	54.7
NA 21267 BTN	10	0017:52	65.8	11743 A	10	0059:37	68.3
N 21280	11	0112:47	79.6	11756 B	11	0153:54	81.9
NA 21292 BTN	12	0012:43	64.6	11768 A	12	0053:14	66.7
N 21305	13	0107:39	78.4	11781 BQ	13	0147:31	80.3
NA 21317 BTN	14	0007:35	63.4	11793 A	14	0046:52	65.1
NA 21330 BTN	15	0102:30	77.1	11806 BX	15	0141:09	78.7
N 21342	16	0002:26	62.1	11818 A	16	0040:30	63.5
NA 21355 BTN	17	0057:22	75.9	11831 B	17	0134:47	77.1
N 21368	18	0152:18	89.6	11843 A	18	0034:07	62.0
NA 21380 BTN	19	0052:14	74.6	11856 B	19	0128:24	75.6
N 21393	20	0147:09	88.4	11868 A	20	0027:45	60.4
NA 21405 BTN	21	0047:05	73.4	11881 B	21	0122:02	74.0
NA 21418 BTN	22	0142:01	87.1	11893 AX	22	0021:23	58.8
* 21430 X	23	0041:57	72.1	11906 B	23	0115:40	72.4
NA 21443 BTN	24	0136:53	85.9	11918 A	24	0015:00	57.3
** 21455 X	25	0036:49	70.9	11931 B	25	0109:17	70.8
** 21468 FD	26	0131:44	84.6	11943 BFD	26	0008:38	55.7
N 21480	27	0031:40	69.6	11956 BQ	27	0102:55	69.3
NA 21493 BTN	28	0126:36	83.4	11968 A	28	0002:16	54.1
NA 21505 BTN	29	0026:32	68.4	11981 BX	29	0056:33	67.7
N 21518	30	0121:27	82.1	11994 A	30	0150:50	81.3

The listed data tells you the time and place OSCAR crosses the equator in an ascending orbit for the first time each day. To calculate successive orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the first crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world, it will descend over you. To find the equatorial descending longitude, subtract 166 degrees from the ascending longitude. To find the time it passes the north pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR when it is within 45 degrees of you. The easiest way to do this is to take a globe and draw a circle with a radius of 2480 miles (4000 kilometers) from the home QTH. If it passes right overhead, you should be able to hear it for about 24 minutes total. OSCAR will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15 degrees from you, add another minute; at 30 degrees, three minutes; at 45 degrees, ten minutes.

OSCAR 6: Input 145.85-145.95 MHz; Output 145.90-146.00 MHz; Output 29.40-29.50 MHz. Mode B: Input 29.45-29.55 MHz; Telemetry beacon at 29.45 MHz. 432.125-432.175 MHz; Output 145.925-145.975 MHz. OSCAR 7 Mode A: Input

Orbits designated "X" are closed to general use. "ED" are for educational use. "BTN" orbits contain news bulletins. "Q" orbits have a ten Watt erp limit. "L" indicates link orbit. "N" or "S" indicates that Oscar 6 is available *only* on northbound or southbound passes. Satellites are not available to users on "NA" days.

Tracking the Hamburglar

STOLEN: Heathkit DX40 transmitter, VFI, VFO, SB301 receiver, s/n 6490878, SB401 transmitter, s/n 10346, SB600 speaker. The transmitter was newly constructed and not yet aligned. Taken from my former residence in Lethbridge, Alberta on February 18, 1977. Richard Loken VE4ABV, 1114-666 St. James St., Winnipeg, Manitoba R3G 3J6.

LETTERS

from page 15

the light of all the extra little unneeded gadgets available on present TV and stereo sets. Why not dispense with them and build a really decent set?

The EIA will also say that government is trying to over-regulate the industry. Well, the rules of free enterprise dictate, and quite rightly so, that if a product is not improved, and needs to be, either the public will mandate it, or the government will regulate it. At this point, the public is not sufficiently aware of the significance of this problem. So, we must rely on regulation to do the job. That is why we need S-864.

I said earlier that S-864 would be a "good start." At this point, this bill does not cover such things as TV/FM antennas and antenna amplifiers, both of which are potential RFI sources, not only to the equipment to which they are attached, but to the equipment of neighbors as well – I should like to see S-864 amended to cover such exigencies.

Arthur Reis WB9YUB
Wonder Lake IL

NO CB – ITU

Several of your readers seem worried about the proposed 220 MHz Class E proposal. On page 36 of the January issue of *Wireless World*, a British publication, we read, "As far as the international control of radio is concerned ... Citizens Band radio does not exist. The countries that operate a service are taking advantage of another agreement made in Geneva that countries may use frequencies allocated elsewhere, provided such use has no effect outside their own borders. It was because of this provision that the FCC had to shelve their plans to introduce a Class E service on 220 MHz. Canada and Mexico said it would interfere with their television services."

This might explain why the FCC is now considering the Detroit-backed plan to use 900 MHz for future CB expansion. It would also explain the extreme actions which the FCC has been considering with respect to linear amplifiers.

I was surprised to learn that the British Post Office controls all the radio communications in England. They have their own WARC disaster since the Postmaster General doesn't think that he has to reveal any of his proposals for WARC. If anyone expects expansion of amateur radio frequency allocations, then they should ask, who will make the proposals?

I've been working on my code and hope to go for my ticket soon. It would appear that in the future all amateur radio may be limited to the code, since everybody is looking for more frequency allocations, and you amateurs have such a fine tradition for giving. I can see it now – in 2027, the FCC is permitting microprocessor-controlled SSB slow scan audio with an ERP of ½ kW, except during Family Time, which was only temporarily defeated by the major networks in the late 70s, during which time transmissions shall be limited to 4 Watts input power at 27.185 MHz.

Alan Ames
Quincy MA

WINTER

Whoever coined the phrase, "when the going gets tough, the tough get going," must have had ham operators in mind.

I would like to bring particular attention to the Cuyahoga Amateur Radio Society (CARS, 146.22/.82), of Cleveland OH. I am sure that this past winter will long be remembered by all, and on 1-28-77, winter dealt its final blow, closing airports, roads, and yes, even whole cities. In their homes, vehicles, and at the Red Cross headquarters in downtown Cleveland, were members of CARS, giving their all in an emergency, throughout the long weekend.

The following were active during the 72 hours that the storm whipped through the Cleveland area: K8TIA, WA8EYF, WB8JSC, W8PSX, WA8GEO, WA8YWN, WD8CHL, K8MBV, K8PPZ, K8AJG, WA8DXY, WD8AJJ, WB8LDA, WA8PIW, and WA8NIL. To all others who assisted in the weather emergency, the entire membership of the Cuyahoga Amateur Radio Society (CARS) would like to extend a heartfelt, "Well Done."

William S. Savage WA8GEO
Seven Hills OH

HORSE AND BUGGY

In reply to your request for input regarding use of our HF bands, I would say that I don't have much comment regarding AM because it just seems to have died a natural death anyway. Why forbid horse and buggy rigs after they're gone? There are times when AM is, in my view, justified, even on 20 meters. Take, for example, when a court strips a man of his funds and possessions, and leaves him in deep financial debt and poor health. (Wouldn't such make one at least in mentally poor health?) And don't say that such doesn't happen! I know that it does, from first-hand experience! All after a fellow is too old to make a new start, and too poor in health as well. So if that fellow has some old gear or can scrounge some, AM could be a means of keeping him from going off the deep end, through moping in his troubles. He could get his mind on other matters by yakking with others. Enough of that.

What I would like to propose are a few frequency use changes inside some of our bands. For example, some foreign stations use frequencies above 14.200 for other foreign contacts. The almost universal use of same-frequency transceivers finds many foreign stations above 14.200 in order to work W/Ks (which I don't complain about). But I would much prefer the old method of "split frequency" operation. There seemed to be far fewer pileup situations that way compared to the messes now. I see no way to outlaw transceivers. That is not my thought. My suggestion for a step toward relief is to *ban* US domestic QSOs in certain portions of DX bands, especially when the band is open for DX to at least a portion of the US. Also, because the "foreigns" are allowed in the "US" portion of the bands, why not be reciprocal? Allow W/Ks to use a portion of what is now DX territory for DX contacts only. My example is referenced to 20 meters, but it can apply to 10, 15 or 40m just as well.

Joe Damke W7KCF
Vernonia OR

CA KW

I wanted to tell you about an incident that happened Sunday evening around 4 pm. I have a sick sister in San Diego CA. She is in her middle 30s. I heard a San Diego operator calling someone on schedule. He called for 30 minutes and no contact. This was on 15 meters. I made a quick break-in and asked if he could make a phone call for me in San Diego. He said, "Sorry, old man, I don't have time."

Wayne, I just got my Advanced in November and I do not operate very much, but is this what the amateurs are coming to? This is the type of ham that raises cane when you get 1000 Hertz off his frequency and call CQ. That is what I started to do. I started to wait until he made his schedule, then move 1 kHz and call CQ San Diego. But, I thought, well the ham bands are getting like CB, so I just won't put myself in his class. A typical California kW. By the way, all my folks live in California. When I was there last year when my mother died, I went to visit a ham that had a fantastic antenna setup, but he was too busy to let me see his shack. Probably 6 kW. We sure need some editorials on operating procedures and our responsibilities as hams in emergencies and to our fellow hams. I have been the communications officer for Civil Defense here since 1968 and believe me, it is hard to get enough licensed hams to help. They want the publicity but don't want the work. I bought them all new equipment plus a 2 meter Motorola repeater, Phelps Dodge duplexer, Hal ID, power supplies, you name it. They use the repeater regularly, but where are they when you need them? My CB is more reliable! I now have gone commercial. A complete setup including mobiles and remote base. I intend to get the job done one way or another. I will equip CBers with commercial radios.

I agree this sounds bad, but the hams, of which I am an Advanced class, are bringing it on themselves.

Franklin J. Christian WA4DIU
Johnson City TN

AR VS. CB

Last summer I got a letter from a friend whose husband had just had a heart attack. Because he was temporarily in Calgary, Alberta, her phone number was under another name. It would have taken hours with Ma Bell trying to locate the number.

So I tried amateur radio. A call to the local repeater elicited, "We'll see if anyone has low frequency capabilities." 48 hours later, no phone number.

My own son, 14 and a Novice, was too frightened to originate an emergency message at his minimal 5 wpm. So many kids jumped on him so fast when he first CQ'd that his operating experience had been unpleasant.

So, we joined the local CB club. We are teaching and graduating quality operators into CB, and working road and weather emergencies regularly.

My son and I will be trying for Technical licenses this spring. We won't give up on ham, but it won't be because CB is bad. It will be because we may face our own long distance emergency situation again.

Foncey Taylor KACF8986
Laramie WY

JAMES

James Electronics gives fast service even here in the Western Pacific. I mailed an order to them on the morning of January 9 and I received it on January 16, while at sea, 500 miles from the nearest land!

Max Cornell WA0SIG
FPO San Francisco

HOT WATER

The following two letters concern the article "An Automatic Thermostat," by George R. Allen W1HCI, which appeared in the January, 1977, issue. After receiving Mr. John P. McDermott's letter, we asked Mr. Allen for a reply. – Ed.

I just read the article on page 62 of the January issue and must say that it is the biggest mess of error-prone nonsense I have ever seen. The author obviously knows nothing about furnace control systems, and you are

nuts to publish the article without having his ideas verified by a competent furnace installer or technician.

To do what he wants you need two items: a second thermostat identical to the first and a twenty-four hour clock switch that can be isolated from the 120 V ac power line. Most of these clock switches can be dissassembled, and the contact wires disconnected from the line cord and reconnected to bridge the outlet socket. Now you have a clock driven switch through which any reasonable voltage can be passed.

Now mount your new thermostat next to the existing one and wire it in parallel, with one exception. Splice the clock operated switch in one leg of the new installation. The new thermostat becomes the day (or high) controller and the existing thermostat is now the night (or low) controller. Set the "on" tripper for days and the "off" tripper for nights. The furnace will always try to satisfy the highest setting it sees.

Now about hot water zone systems. You need a thermostat and clock for each and every zone. Also watch out with hot water systems. Many use line voltage thermostats. It saves the cost of a motor relay. A word now about what happens in a hot water system.

The wall thermostat controls only the circulator pump, and not the burner. When the thermostat calls for heat, the pump is started. This brings colder water into the boiler bottom as the hot water is pushed out the top. This cooling of the boiler controller causes it to close its contacts and fire the burner. This cycling continues until the wall thermostat is happy and the boiler controller is satisfied.

There are three basic hot water zone types. Two are manifold types and the third is a ring loop. (1) Here the water inlets and outlets are manifolded and each zone has its own thermostat and circulator pump. Quite often these are line voltage thermostats. (2) Here we have the manifolds again, but we use solenoid or motor valves for each zone. This requires a three wire thermostat. The extra wire is used to control the pump. There is only one pump on this system, and it must run as long as there is any demand in the system. (3) This system uses a single pump, a single loop of pipe, and a thermostat and valve for every room. The same three wire requirements apply as in (2) above.

Any three wire system should use DPDT switches to remove the unused thermostat from the circuit. This complicates things, as the clock assemblies for this type of system would have to be handmade. But it could be done, and is probably worth the effort.

John P. McDermott
Stratford CT

Mr. McDermott's comments are in error, with the exception of his description of "three basic hot water zone types."

As a reputable author, I take pride in the accuracy of the articles that I submit for publication. All of the articles that I have submitted for publication over the past ten years have been checked in concept by other authorities prior to submission for publication. This article was no exception. In this case, I checked with a local professional engineer who is knowledgeable in heating systems, and a manufacturer of furnace control systems. Furthermore, prior to installation of the unit on my own furnace, I checked with the contractor who installed my furnace during the construction of my home. These three authorities indicated that my ideas were sound and feasible. They did caution me not to attempt to describe every possible heating system and their resultant variations. They advised me to discuss the two common, simple systems discussed in the article in order to keep the article clear and concise. I therefore must take exception to Mr. McDermott's statement that the article is "error-prone nonsense." Instead, the article was verified by competent authorities.

Mr. McDermott states that, "To do what he wants you need two items: a second thermostat identical to the first and a twenty-four hour clock switch. I suggest that Mr. McDermott reread the article one more time, especially the section entitled "Principles of Operation." Mr. McDermott should also take notice of the schematic in Fig. 1 and the parts list at the end of the article. Upon reviewing the article one more time, Mr. McDermott will surely notice that the clock switch is present (Tork 1101 or Sears models) and is isolated from the power line by the 117 V ac relay. The second thermostat is also present and is referred to as the "night thermostat." Mr. McDermott is in error when he states that the second thermostat must be the same as the first thermostat. The second thermostat must be of good quality, such as the thermostat recommended in the article. In some cases the "on-off lag" of the thermostat may have to be adjusted. The instructions that come with the thermostat will describe any such adjustments if they are required.

Mr. McDermott supplies a sketch and description of an alternate connection for the clock switch. Mr. McDermott's connection will only handle a single thermostat. It will not perform the function as described in the article. Mr. McDermott has supplied this sketch since he has stated that ". . . you need a thermostat and clock for each and every zone." This statement is incorrect. For home heating purposes, only a single, centrally located, "nighttime" thermostat is required. As mentioned in the article, temperature uniformity is not maintained throughout the house when the system is in "nighttime" mode. However, as stated, this is of little consequence.

I regret that the article was necessarily limited to "automatic control" of only two simple, generalized, heating systems. However, time does not permit a discussion of all heating systems and their variations. If the experimenter has a heating system that does not conform to the examples in the article and is unable to adapt the automatic thermostat to his system, he can drop me a note and I will attempt to help via letter.

It should be noted that as of this time there are currently four of these systems operational in my neighborhood. (The first systems have just turned three years old.) All four systems have performed well without problems and have given their owners significant savings.

George R. Allen W1HCI
80 Farmstead Lane
Windsor CT 06095

EXTRA CLASS

I'm taking your advice in the preface of the *73 Amateur Extra Class Study Guide* — drop you a letter when the license arrives! Since instant upgrading is in effect, I don't have to wait.

I'd like to thank you and your technical editors for a truly outstanding study guide. I'm a nuclear submarine officer and have been away from amateur radio for about six years. I picked up a copy of your study guide, studied it over a two week period, and that was that. I especially appreciated your practical examples and informative approach. I truly enjoyed reading the guide — as surprising as that may seem to most.

Also, I just took out a subscription to your magazine. I was impressed by the variety of articles in your January issue. I hope the future issues are as good. Keep up the good work.

Ed Giambastiani WB2CTK
Cassota NY

AMP BAN

The FCC released a Notice of Proposed Rule Making, Docket 21116, on 18 February, 1977. This ominous docket would prohibit the manufacture of any amplifier capable of operation between 24-35 MHz. If adopted as a Report and Order, you will no longer be able to purchase an amplifier with 10 meter coverage. Sunspot activity during the next few years will peak, and the loss of this privilege should be of concern to you, no matter what your license class. Comments must be filed on this docket by 25 May.

In an even more disgusting NPRM released on 18 February, docket 21117, the FCC proposes type acceptance for all amateur transmitting equipment. Type acceptance is an expensive, complicated and slow bureaucratic process. It will increase costs of amateur gear! Costs will double, possibly triple, or maybe even quadruple. Small manufacturers will be forced to close their doors, or abandon the ham market. Comments must be filed by 25 May.

Explaining the need for these new rules, which they acknowledge will punish licensed law-abiding amateurs, the Commission cites increasing abuse of amateur transmitting equipment (currently exempted from type acceptance) by CBers and unlicensed operators who have taken over the frequencies just below 10 meters . . . or in some cases frequencies in the 10 meter band.

In anticipation of these dockets, the San Antonio Repeater Organization filed a petition for rule making with the FCC before their release. Briefly, this petition, assigned Rule Making No. RM-2839, requests that FCC license equipment dealers of non-type accepted equipment and require proof of a valid amateur operator's license for purchase, with appropriate mandatory fines for violations. Nothing in dockets 21116 and 21117 would stop acquisition of amateur transmitting equipment by non-amateurs. It could then be easily modified to cover 11 meters, or used on our amateur bands by unlicensed operators as it now is. FCC is going to do something about the problem. SARO doesn't want to cause serious loss of privilege or inconvenience to any licensed amateur. Certainly we want new rules to effectively end this problem.

The FCC, in the above dockets, asks amateurs to suggest reasonable alternatives. SARO has, yet pressure is obviously needed so that the Petition RM-2839 will receive the consideration it merits.

Bob Wheaton W5PKK
San Antonio TX

PETITION FOR RULES AMENDMENTS

The San Antonio Repeater Organization, a nonprofit society of amateur radio operators, dedicated to the advancement of Amateur Radio Communications and the preservation of this radio service in the public interest, respectfully requests the Commission to amend Part 97 of its rules to provide for adequate restrictions on the sales of transmitting apparatus and rf power amplifying devices currently exempt from regulation under the equipment type acceptance or type approval programs. We further request that the Commission establish a dealer licensing program for dealers engaged in the sale, lease, trade, shipment and distribution of non-type accepted or non-type approved transmitting apparatus at the retail level, and provide for mandatory penalties for any party, who during or after the original retail sale, delivers or causes to be delivered, any such transmitting apparatus to any individual or group of individuals not in possession of a valid license

GOLDEN ROAD KIT

ALL YOU NEED TO BECOME A HAM

see page 220

authorizing its use.

In support whereof, the following is respectfully submitted:

1. The absence of such regulations has been responsible for the proliferation of variable frequency oscillators, linear amplifiers and other transmitting equipment manufactured and sold as intended for the amateur radio market, and thereby protected by the technicality which exempts such equipment from the type acceptance or type approval programs. Much of this equipment is obviously, by its very design, manufactured and sold primarily for unlawful use outside the amateur radio service bands by citizens band or unlicensed operators. The manufacturers' claims that such equipment is intended for the amateur radio market are a subterfuge to permit circumvention of the Commission's Rules, since it is of little or no value for use by the serious radio amateur.

2. Transmitting equipment manufactured and sold by this devious method of rules circumvention is known, by the Commission and others, to be a primary cause of interference to radio and television receivers operated by the general public, and is known to be responsible for significant interference to lawful users of the citizens band radio service, the amateur radio service and other users of the radio spectrum, notably in the public service, marine, aircraft and commercial services. The vast number of persons using the citizens radio service makes it mandatory that they observe closely the 4 Watt transmitter output, as well as other restrictions in Part 95 of the Commission's rules. Harmful interference to other spectrum users caused by lawful operation of citizens band equipment is almost negligible compared to the disruption to legitimate communications caused by illegal citizens band operators, and the new breed of lawless and unlicensed pseudohams, variously described as HFers, whiskey groups, etc., which utilize both unauthorized frequencies in the 26-28 MHz spectrum and transmitter output levels often in excess of one kilowatt.

3. The Commission's ban on CB linears, effective January 23, 1976, is proof that the Commission is both aware and concerned about the harmful effects caused by equipment intended for illegal use by citizens band operators (Part 95) but manufactured and distributed in circumvention of those rules through the false assertion that they are intended for the amateur radio market, and therefore fall under the protective exemption of the type acceptance and type approval programs. While this ban was intended primarily to end future availability of linear amplifiers for use by citizens band operators, it has been effective only in eliminating the VHF (low band) class "C" amplifiers, marketed by reputable manufacturers, which, due to their non-linear amplification characteristics, were of no value in illegal citizens band use. The manufacturers' circumvention of the rules was made possible through technical advances in amplifier design, permitting them to be successfully broadbanded and therefore outside the jurisdiction of the ban.

4. Clearly, the exemption from the type acceptance and type approval programs of transmitting apparatus designed and manufactured solely for use by radio amateurs has made the job of rules enforcement more difficult. However, in spite of recent statements by Commission personnel, that the Commission intends to investigate the possibility of requiring type acceptance for all commercially manufactured transmitting equipment, we submit that the inclusion of amateur equipment into the type acceptance program would fail to get to the heart of the problem. Conversely, a total ban on all forms of linear or rf power amplifiers, an alternative known to be under consideration by the Commission, would be shortsighted and prejudicial to many lawful and conscientious users, and would also fail to stop the availability of high powered transmitters to unlicensed operators. The amateur transceiver offering a power input of two kilowatts PEP, with 11 meter "receive only" provisions, would simply replace the lower powered versions currently available. Clearly, none of the alternatives mentioned so far would effectively control the problems.

5. Simply stated, the problems are primarily the availability and abuse of amateur radio transmitting equipment, by non-amateurs, for unlawful purposes, and the tremendous interference they cause to other radio services' owners of radio and television receiving devices. Much of this interference must be presumed to originate from transmitters operated by the unlicensed pseudoham operators mentioned earlier.

6. A high level of technical competence is necessary for the proper construction and operation of high powered transmitting equipment. Exemption of amateur radio equipment from the type acceptance and type approval program is evidence that the Commission presumes that amateur radio operators will possess the required level of competence, having so demonstrated by successfully completing technical and operational examinations administered by the Commission. Amateurs have done nothing to warrant a change in the Commission's views on this matter. To the contrary, while few of the citizens band or outlaw pseudohams possess more than a rudimentary knowledge of transmitter operation, and have no reserve of knowledge to draw upon in the event of interference to other services, amateurs have demonstrated the highest level of competence and concern in matters of interference and have formed many interference committees to assist when necessary.

7. To eliminate such abuse by persons not licensed to use amateur radio equipment, to stop unlawful encroachment into the amateur bands, and to secure the amateur's future freedom to experiment and develop new communications techniques while providing valuable public service, we recommend that the Commission abandon all other alternatives, in favor of rules changes which would require a valid operator's license for the purchase of any non-type accepted or non-type approved transmitting apparatus. The licensing of dealers engaged in retail trade, in a manner styled after the federal firearms license, as it applies to retail firearms dealers, is certainly indicated. A point of sale registration should be implemented, with appropriate provisions to make it impossible to circumvent the rules through mail order or export sales. The rules change should empower the Commission with jurisdiction in both the original sale, at retail, and subsequent resale by individuals as used equipment. Mandatory penalties for willful violations are recommended. To preclude continued circumvention, such as the inclusion of a disabled transmitter, sold as a receiver only, and type accepted under Part 15 of the rules, any piece of receiving equipment containing additional circuitry not necessary to perform its stated purpose, or kits of parts for home construction of amateur transmitting apparatus, must be presumed to be operational at the time of sale.

8. We respectfully petition for these rules changes, not because the majority of licensed amateur radio operators are guilty of violating their code of ethics, but as the only effective means to control the commercial greed which has promoted such abuses. It is offered as the only reasonable alternative to the Commission's current consideration of more restrictive rules changes in its effort to resolve these dilemmas. We are convinced that such rules changes would cause a minimum of inconvenience to the lawful pursuits of the amateur radio service, and simplify the Commission's enforcement problems to the extent that new personnel would not be necessary to administer a dealer licensing program. We are hopeful that strong regulation of sales will stop the rash of new state and local laws attempting to deal with the radio and television interference problem, most of which are intended as nuisances only, and usurp the Commission's authority to regulate transmission of radio signals.

Wherefore, the premises considered, the Commission is respectfully requested to issue a timely notice of proposed rule making to amend Part 97 of the rules in the manner petitioned.

San Antonio Repeater Organization

MORE BAN

To the FCC:

This Society of 750 licensed amateur radio operators endorses petition for rule making RM-2839, submitted by the San Antonio Repeater Organization. During board action on 19 March 1977, after hearing reports on Dockets 21116, 21117 and petition for rule making RM-2839, directors voted to endorse petition RM-2839.

In support whereof, the following is respectfully submitted:

1. In consideration of rapid advances in the state of the art, and the amateurs' need to adopt and further develop new communications techniques, it is in the Commission's best interests not to impose type acceptance regulations on amateur transmitting equipment to attempt to control unlawful use by non-amateurs, if more effective means are available.

2. RM-2839 proposes more effective means for the Commission to achieve its goal, without imposing unreasonable restrictions on the licensed radio amateur. The simplicity of enforcing regulations proposed in RM-2839 should appeal to the Commission. Substantial savings in budget and manpower would result, permitting more vigorous enforcement in problem areas.

3. Failure to implement restrictions proposed in RM-2839, or adoption of 21116 and 21117 as reports and orders will perpetuate circumvention by failing to interrupt the supply of equipment easily modified for unlawful use by non-amateurs.

Wherefore, the premises considered, the Commission is respectfully requested to consider RM-2839 as a more effective and desirable alternative for the Commission and licensed amateurs.

Texas VHF FM Society, Inc.
Lawrence S. Higgins W5QMU
President
San Antonio TX

BROADCASTING

Federal Communications Commission
Washington DC

Comments on RM-2830, Rebroadcast of CB and Amateur Transmissions.

As a radio amateur, I am not opposed to the intent of this petition by the National Association of Broadcasters to provide a more direct channel by which radio amateurs and other services may communicate emergency and safety information to the public at large. I am concerned, however, by what I feel is inadequate assurance that such rebroadcasting privilege would not be abused by competitive, commercial broadcasters and their news departments, nor do I see where adequate provision is made to ensure that such rebroadcasts would be made only with the permission of all participants.

I do not feel that it would be in the best interest of the amateur radio service to have broadcast news people monitoring, and recording, our frequencies in hopes of hearing some interesting, "newsworthy" item which they could interpret as pertaining to "public safety and convenience," to be incorporated into a commercially sponsored news broadcast. Neither would it be appropriate, in my opinion, to air a regular "traffic report" or other such regular program originating through amateur radio. Such uses of amateur radio could be construed as commercial, or

pecuniary, in the competitive broadcasting market.

On my second point, I feel that it should be required that a broadcaster obtain consent of all persons whose radio transmissions were recorded or monitored before such transmissions are rebroadcast, keeping in mind that amateur communication usually involves two or more (often many more) stations. In the situation of broadcast personnel monitoring the amateur radio service for news, is it proposed that the broadcaster have an amateur license so that he can operate an amateur station, break in on the conversation, and ask all the participants for their consent to rebroadcast? Or would such rebroadcast privilege be limited only to such communication as emergency traffic networks, where prior consent of the participants could be obtained?

I feel that the NAB petition fails to set forth adequate guidelines for the broadcast industry that would protect the amateur radio service from unauthorized or commercial use, and that action to relax the current protection afforded by the regulations should be deferred until such time that the amateur operators have had an opportunity to review and comment on this important matter.

Jerold R. Johnson WA5RON
Austin TX

ASCII

Federal Communications Commission
Washington DC

I have been a licensed radio amateur for over 25 years and have advanced through the ranks from Novice to Extra class. My activities in amateur radio have been of tremendous importance to my vocation. I am Technical Director of a 5 kilowatt directional AM station and a 100 kilowatt FM station with stereo and SCA, and have been recognized as a Senior Broadcast Engineer by the Society of Broadcast Engineers.

I owe much of my success in broadcasting to the opportunities for experimentation and hands-on experience afforded only by amateur radio. One can do very little "experimenting" in the broadcast business; it must be right the first time.

The present state of the art in amateur radio has outmoded the rule allowing only the use of the Baudot code for the transfer of information between amateur stations. Most of the teleprinter machines that use this code are obsolete and repair parts are no longer available from the manufacturer.

The current trend toward the use of microprocessors in amateur radio oriented applications is growing rapidly and appears to be a major step forward. These systems generally use the ASCII 8 level code for information interchange and the use of ASCII on the amateur frequencies would allow greater interchange of experimental information without the necessity for conversion to and from the obsolete Baudot code with the attendant possibility of error.

My position is to support the approval of RM-2771.

Melvon G. Hart WØRV
St. Louis MO

A MICRO OS

I read with great interest the article published in the March, 1977, issue of *73 Magazine* entitled, "Save Time With A Micro OS." The article was submitted by Mickey and Foxy Ferguson of PO Box 11104, Chattanooga TN.

I have put this OS into my system just as it was published. I have checked and double checked to make certain that I have made no mistakes. I find that the block move, the zero memory, the tape write, and the tape read functions all work fine. I have not been able to list a program. I believe that this is due to my not using a PR-40 (I use a teletype located in the control position). The program was written to print out at 800c. I did change this address to 8004 to no avail. I suspect that the PR-40 being a parallel device is the difference. The dump also stops the program, I suspect for the same reason.

Of more concern to me is that I believe that I have found two places that the program jumps to addresses outside of the program. I do not know where they should jump to, and this is the reason for my letter. I believe that as printed the address at location 035F is incorrect, as it jumps to address 0456. Again at address 0383, the jump is to address 0467.

Could you please advise me of where these addresses should jump to? I would like to use this program, as I think that there is much to be gained from it. I have already used the block move function to advantage in writing some programs. It is very handy when I forget something — I can move the program down and insert what I have left out.

I would also like to encourage the author to write up another article to tell what he did for the PROM that he is using in his system.

Jack A. Inman
Covina CA

May I begin with an apology to Mr. Inman (and all others fortunate enough to have a hard copy device for their control terminal). I should have included the necessary information in the article on moving the dump and list functions to the control terminal. This is quite easy to do, as only a single change to the OS is required. Change the three bytes beginning at $01EA to $7E E1D1. Also, if the device that you have at the control terminal can print sixty-four (or more) characters per line, you may wish to change the byte at address $01AD from $08 to $10, as this will print sixteen bytes per line instead of the eight bytes per line required by the short (40 character) line length of the PR-40. I might add that several improvements have been made to the operating system since the article was submitted to 73 (is any piece of software ever really completed?). If anyone cares to have them, send me an SASE and I will send you a copy of these improvements.

I would also like to add that the dump that was published with the article is correct as published. If you have difficulty in getting any function to run, I would suggest that you recheck the contents of your computer's memory against the memory dump in the article. To answer Mr. Inman's question about the program branching outside itself, it does not. In Mr. Inman's first example (adr. $035E, instruction $26 F6), the $26 is a branch not equal instruction and the $F6 is the offset. In the M6800, this offset byte is a signed *number, which can perhaps be summarized as follows: If the most significant bit of the offset byte is a zero, then the branch is forward; if the most significant bit of the offset byte is a one, then the branch is backward. So, instead of branching forward by $F6 bytes to address $0456, it actually branches backward by $0A bytes to address $0356. This (branching backwards) also applies to his other example, which is a $26 B3 and branches backwards to address $0367.*

In response to Mr. Inman's question about my PROM board, I must admit that I have been too busy to do it as yet — I'm still using the OS in RAM memory. But several good PROM boards for the SWTPC M6800 computer are available from MSI (Midwest Scientific) and Smoke Signal Broadcasting. I would encourage all those who have written and called me about this to check these two sources. — M.F.

10M CB

I have been giving some thought to the idea of using modified CB rigs on 10 meters and I feel that if an across-the-board shift of +2.440 MHz were made, it would provide the perfect "band plan."

Some of the benefits I can see for the amateur service through this type of conversion are — (A) make amateur radio more attractive to prospective hams, now CBers, by providing them with a low cost means of getting on the air after they have passed the amateur exam; (B) encourage more prospective hams and Novices to go for the General class as soon as possible and not stagnate (as I did) as a Technician for years; (C) provide relief for the congestion on 2m FM in major metro areas; (D) provide an alternative to 2m FM for "rag chews"; (E) provide effective inner city mobile communications without high rental repeaters; and (F) protect, by use, the upper reaches of 10 meters.

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The response to CB-10m conversions has been encouraging. We presently have several articles in production describing the process with several different types of CB radios. If anyone has completed a conversion, write it up and submit your work to 73. Don't keep all that originality to yourself! I wonder if anyone has modified one of the CB base or mobile antennas for 10 yet. — Ed.

Ten Meter Band Plan For Converted Citizens Band Transceivers

CB Freq.	Channel #	Amateur Freq.*	Notes
26.965 MHz	1 or A	29.405 MHz	1
26.975	2 or B	29.415	1
26.985	3 or C	29.425	1
27.005	4 or D	29.445	1
27.015	5 or E	29.455	1
27.025	6 or F	29.465	1
27.035	7	29.475	
27.055	8	29.495	
27.065	9	29.505	2
27.075	10	29.515	
27.085	11	29.525	
27.105	12	29.545	
27.115	13	29.555	
27.125	14	29.565	
27.135	15	29.575	
27.155	16	19.595	3
27.165	17	29.605	3
27.175	18	29.615	3
27.185	19	29.625	3
27.205	20	29.645	3
27.215	21	29.655	3
27.225	22	29.665	3
27.255	23	29.695	3

Notes:
1 — Shown alphanumeric since many transceivers of six channels are shown either way.
2 — Since many CB sets came with channel 9 or have had it installed, this would be a good choice for a National Calling Frequency.
** — OSCAR enthusiasts should not be hampered nor should any other more exotic modes be annoyed if these converted rigs were to be used without any amplifiers.*
3 — These could be used, via a gentleman's agreement, strictly as local "rag chew" frequencies.

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Nanticoke PA 18634

Two Meter Scanner

-- for the IC-230

After fighting a continuous battle with crystal manufacturers to get delivery of crystals for the local repeaters, I decided to take the big step and go synthesized. A review of the synthesized rigs available at that time resulted in the purchase of an Icom IC-230 which was on display at a ham radio outlet near a hamfest I was attending.

The rig seemed to have all the features necessary for efficient 2 meter operation: coverage of all standard repeater and simplex frequencies, 10 Watts output, plus or minus 600 kHz transmit capability from receive frequency (the receive frequency is set up on the front panel), and helical resonators for increased receiver selectivity. The latter feature proved invaluable when a new repeater came on in the area and the locals began having intermod problems when it and the other strong local repeater were on at the same time. I found that the IC-230 completely solved my intermod problems. The only problem I had now was that with my previous base setup, I had incorporated a scanner built into the rig to monitor four of the local repeaters plus 52 simplex. When I sold it, I lost my scanning capability, which I sorely missed.

At first the thought of a system that would enable me to scan a synthesized rig seemed like a formidable electronic feat. However, upon closer inspection of this little beauty, it seems that Icom has done most of the work needed.

Brief Operation of the IC-230

The received frequency is converted to the 10.7 first i-f by being heterodyned against the sum of the frequencies generated by the LO and CO oscillators in the phase locked loop section of the rig. For example, when receiving 147.21, the LO frequency is 13.916 MHz, multiplied by 9 internally, or 125.245 MHz, and the CO frequency is 11.265, for a total of 136.51 MHz. The difference between the 147.21 MHz receive frequency and the 136.51 phase locked loop frequency is the i-f frequency of 10.7 MHz. Refer to Fig. 1 for determination of LO and CO frequencies for the receive frequencies desired. The black areas are frequencies available. Fig. 2 is a basic block diagram of the receiver and should give you better insight into the operation of the receiver.

Fortunately, in the phase locked loop section, Icom has thoughtfully provided a switch position ("V" on the 10 kHz switch) which disables the internal CO oscillator and uses it as a buffer for an external VFO. The input to this position is available on a nine pin accessory socket on the right side of the unit. This is meant to be used with a VFO between 11.255 and 12.255 MHz and will cover 146 to 147, or 147 to 148 MHz, depending upon which switch position the MHz switch in the upper left hand corner is in. As a matter of fact, of the connections needed for a successful scanner attachment, i.e., rf injection, ground, plus 12 volts, ptt line access, and squelch access, only the squelch access is not already available at the accessory socket. This, however, is quickly remedied by a 10 minute modification to the transceiver which requires no defacing of the unit and is completely reversible in even less time. This will be described shortly.

Armed with the knowledge of how the unit works and what points are available, it seemed the easiest approach was to build an external oscillator which injected the proper frequency into the CO buffer to enable monitoring of the frequencies of my

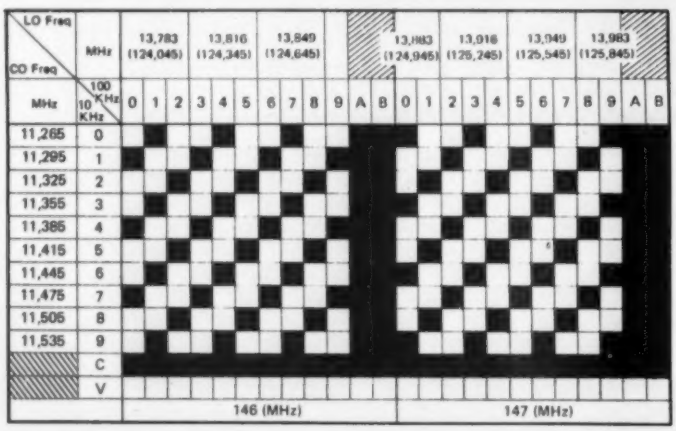

Fig. 1. LO and CO frequencies for receive frequencies desired.

choice. With the MHz switch in the "146" position and the 100 kHz switch in the "9" position or, alternately, the MHz in the "147" position and the 100 kHz switch in the "1" position, the LO frequency selected is 13,849 x 9 or 124.945 MHz. To determine the CO injection frequency needed: F = frequency to be monitored minus 124.945 minus 10.7. For example, crystal needed to monitor 146.94 would be 146.94 minus 124.945 minus 10.7, or 11.295. Using one of these switch positions enables you to monitor 146.5 to 147.5 MHz covering simplex and repeater outputs. Using the above formula, the crystal frequency for 146.52 works out to be 10.875 MHz, which is below the 11.255 range for external CO input specified by Icom. However, both IC-230s I own operate very well at 52 anyway.

An added advantage is the capability to scan transmit and receive with a single crystal. There is one thing to watch: When the scanner stops on a particular position, you must notice whether it is a 146 MHz repeater, a 147 MHz repeater, or a simplex frequency, and move the offset switch (located on top of the unit) accordingly or the toggle switch to "direct" for simplex. Transmit and receive scan capability is possible with a single crystal because the CO and LO oscillators are common to the transmitter and receiver.

IC-230 Modification Steps

1. Remove bottom cover of IC-230.

2. Locate two small coaxial cable center conductors connected to pin 9 of the accessory socket, unsolder from pin 9, solder together, and tape. This removes a "CO output" point from the accessory socket.

3. Run a wire from pin 9 of the accessory socket to pin 14 of U4E, the AF board. The AF board is the third compartment from the rear. With the rear of the set facing

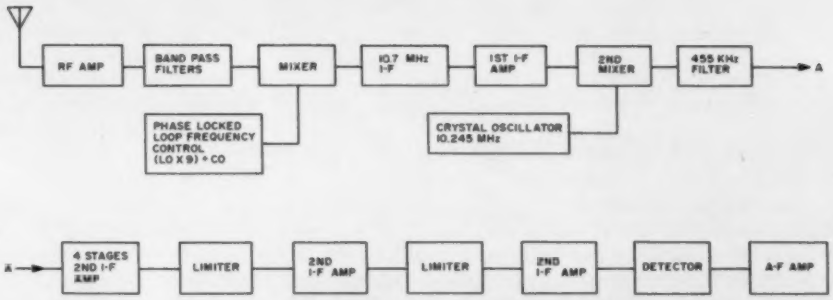

Fig. 2. Receiver block diagram.

you, pin 13 can be located just to the left of center and is the only pin on the board without a wire connected to it. It is the squelch test point and will be used to obtain the signal which stops the scanner.

The scanner can be built on a piece of vectorboard and parts layout is not critical, but keep in mind good building practices, including keeping all leads as short as possible. Fig. 3 shows the scanner schematic.

Circuit Description

IC1, a 7414 TTL IC, is a hex Schmitt trigger. Since the squelch voltage of the IC-230 rises and falls relatively slowly, a Schmitt trigger is needed to process that signal to provide an output with a sharp rise and fall time for positive starting and stopping of the scanner. Q11, in conjunction with R1 and C1, provides a time delay to hold the scanner on frequency for a short while after the carrier drops. With the values shown, the delay is approximately 5 seconds. The time delay can be increased by increasing the value of C1 or decreased by decreasing C1.

IC2 is connected as a clock which provides the pulses that tell the scanner how fast to scan. Scan rate can be increased by decreasing the value of C2 or decreased by increasing its value. A word of caution: Increasing clock speed too fast will result in the IC-230 not being able to "lock on" to the externally generated frequency and only sporadic scanning of some channels will be realized.

IC3 is a decade counter which counts the input pulses and presents them in binary form at pins 8, 9, 11, and 12.

IC4 is a BCD to decimal decoder which takes the BCD output of IC3 and converts it to decimal form, bringing the lines connected to pins 1, 2, 3, 4, 5, 6, 7, 9, 10, and 11 to ground one at a time, lighting each LED in sequence and, at the same time, turning on Q1 through Q10.

When Q1 through Q10 turn on, they activate one at a time Y1 through Y10, which generate, in conjunction with Q12, the frequencies needed by the IC-230.

IC5 is a simple regulator which supplies the IC circuitry with 5 volts from a 12 volt source.

If 10 channel operation is not desired, 2, 4, or 8 channel operation can be had by ungrounding pins 2 and 3 of

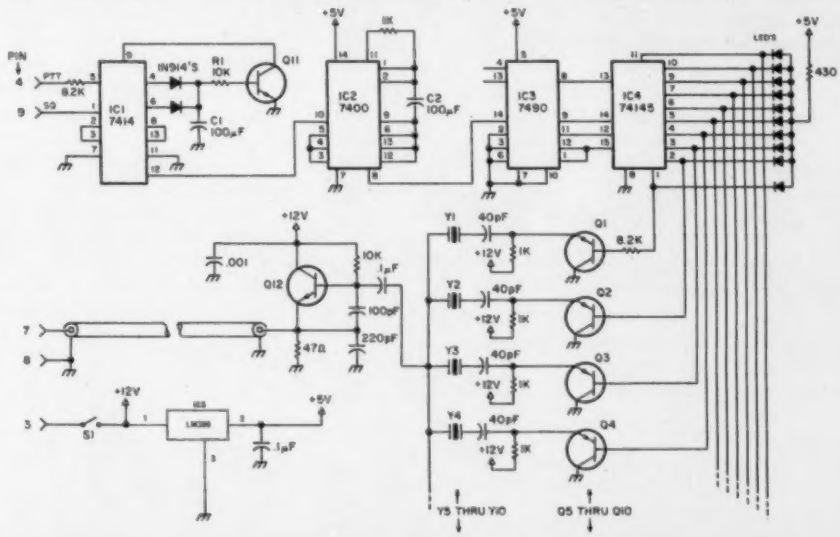

Fig. 3. Schematic. Q1-Q10 — 2N3638 or equiv.; Q11 — 2N2102 or equiv. (any NPN silicon); Q12 — 2N2102 or equiv.; Q13 — 2N3055 or equiv.

IC3 and tying them to pins 9, 8, or 11, respectively. Five channel operation can be accomplished by tying together pins 1 and 6, 2 and 7, 3 and 9, 4 and 10, and 5 and 11 of IC4. Of course, you would only use the amount of transistors and associated circuitry needed to scan the desired number of channels. For example, if only 5 channels are required, omit Q6 through Q10 and components connected to their base and emitters.

Operation

Set "MHz" switch to "146", the 100 kHz switch to the "9" position, the 10 kHz switch in the "V" position or, alternately, the MHz switch in "147", 100 kHz switch in "1", and 10 kHz switch in "V". You will note that the meter light is out, indicating that the IC-230 is not getting a CO oscillator frequency.

Turn on S1; the scanner should now scan and the meter light will be on. If a channel is active, the scanner will stop on that channel. It will begin scanning again after a five second delay when the repeater goes off. If you wish to transmit on a frequency on which the scanner has stopped, simply check to be sure the A-B switch is in the proper position for the repeater you are listening to, or the on-off switch is in "dir" for simplex operation. Simply key the mike button to communicate on that frequency. As stated before, transmit and receive frequencies are scanned simultaneously using one crystal.

Crystal Ordering Information

This circuit will work well with International Crystal Manufacturing Co. catalog #031300 crystal or equivalent. Price is $4.25. The only possible disadvantage might be the physical size. These crystals are the HC6/U type and not the type you normally find in 2 meter equipment. ■

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Try the Mini-Timer

-- prevents HT timeouts

The necessity for a timer on repeaters to limit the length of individual transmissions has generated several circuits that the individual ham can use to avoid timing out. None of those that I have seen, however, were appropriate for my purpose, which was to limit my monologues from the car with my Midland hand-held. I wanted a "time out" circuit that would fit entirely in the HT, draw little current, give a loud warning, and not otherwise affect the operation of the rig. The circuit in Fig. 1 fits all these criteria and in addition is cheap and easy to build.

Circuit Description

IC1 is an NE-555 connected as a timer. C1 and R1 determine the timing length. With the components pictured, the timing cycle is about 90 seconds. A small trimpot would give considerable variation above and below this. With pins 2 and 4 connected together and at ground potential through the 10,000 Ohm resistor, the timer is inhibited. Point A is connected to any part of the T-R switch that goes from neutral or ground potential on receive to 12 volts on transmit. When this happens, the timing cycle begins and, unless reset, will eventually go on to time out, causing pin 3 to go to ground. This in turn activates IC2, which is connected as an astable oscillator at about 1000 Hz. Its output drives the transceiver's internal speaker directly through a capacitor. The output is loud enough to be easily heard within a room or car. The tone will sound until the mike button is released and then it resets.

The circuit draws 7 mils on standby and 50 mils when sounding off. I found that I could eliminate all current draw on receive by connecting the points C and A together, therefore only supplying voltage to the unit on transceive. However, when this was done, the oscillator would occasionally go off when the mike button was pressed. Some fiddling with the circuit would probably correct this if the 7 mil draw is unacceptable.

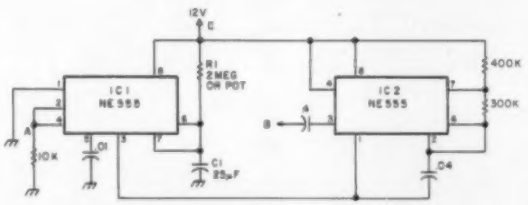


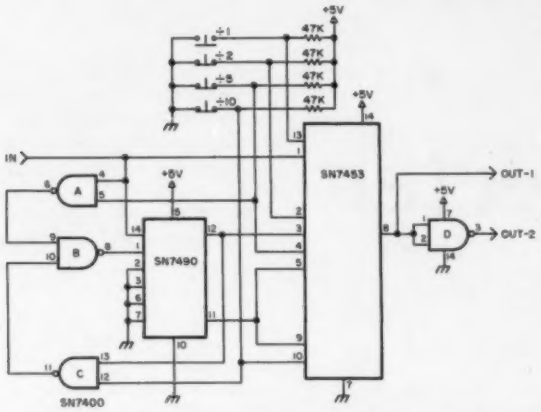
Fig. 1. The Mini-Timer.

Two additional points: The unit will sound for about ½ second when the set is turned on, confirming the operation of the timer. I have also noticed that when my batteries begin to run down, the timer begins to emit chirping sounds on receive. I find this a convenient signal to recharge.

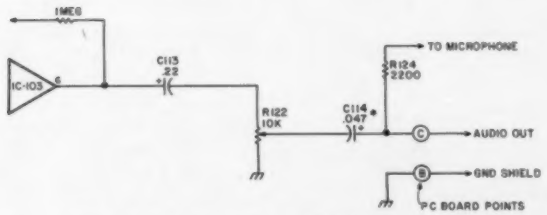
Any construction method will do and none of the component values are critical except the voltage tolerance of the caps. An NE-556 (double 555) cannot be used since both ICs share a common ground and this obviously won't work in this circuit. ■

Circuits²

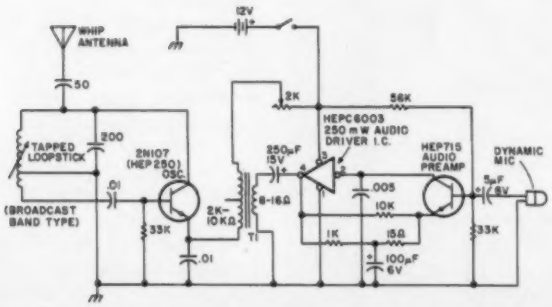
Want a free copy of any 73 publication? Sure you do. Just send in your favorite circuit, or even one that you don't especially like. If we print it, you take home the book of your choice. Just be sure to specify which book you want. OK?



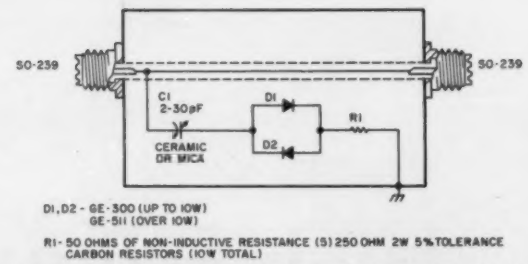
This circuit permits an input square wave to be divided by one, two, five, or ten, depending on which switch is in the open position. The signal at "OUT-1" will be inverted and the signal at "OUT-2" will be non-inverted with respect to the input. Thanks to Eric Grabowski WA8HEB.



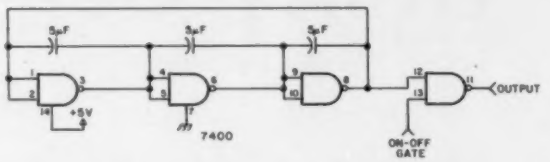
Here's a way to match the Heath HD-1982 Micoder to low impedance transceivers. To get around the Hi-Z condenser mike supplied with the Micoder, substitute a 15k ¼ Watt resistor for C114 (.047 uF) capacitor in the audio output circuit. This mod has worked with the Midland 13-505 and Wilson 1402 SM HT. You may have to experiment with different values to find the right match for your transceiver. Thanks to W8FX.



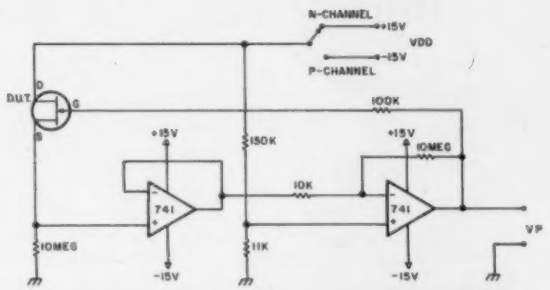
Here's a 1-2 MHz broadcaster transmitter. T1 is a low impedance output transformer, 5000-8 Ohms. Thanks to WA5RON.



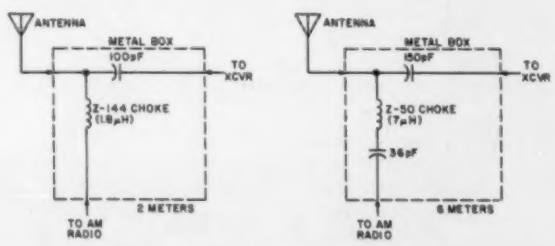
An attenuator useful on all of the amateur bands, but designed with 2m in mind. Capacitor C1 couples the appropriate amount of rf to switching diodes D1 and D2. D1 and D2 conduct only on transmit and pass the rf on to resistor R1. The attenuator is constructed in a minibox sized 3-1/4 by 2-1/8 by 1-1/8. Note that C1 can be mounted using a stiff piece of wire or a terminal strip. All leads should be kept at minimum length. Rf is present on both sides of C1 and must be insulated from the chassis. A small hole can be drilled in the box so C1 can be adjusted using an insulated shaft alignment tool. Thanks to Donald Bohm WBØFLG.



An audio oscillator from a 7400 TTL chip. The output waveform is a sawtooth and will drive other TTL devices. With the values shown, the frequency will be about 800 to 1000 Hz. Thanks to K7HKL.



A very simple circuit for measuring JFET pinch-off voltage. It's particularly handy when trying to match field effect transistors of the same generic type. The circuit also makes it easy to measure the bias range of an FET. The op amps sense the source current of the FET via the first 10 meg resistor. The first 741 is a buffer; the second 741 is preset to 1 volt and its output drives the device under test (DUT) until the source current equals 100 uA. This voltage then can be easily measured with a VOM or VTVM. All resistors are 5%, ¼ W. The polarity for Vp will be opposite with respect to VDD, which is correct since Vp is the reverse bias cutoff voltage. The cutoff current is set for approximately 100 uA. Thanks to Gerry Gannon, Phoenix AZ.



If you're thinking about a disguised antenna system to ward off the Hamburglar, this pair of circuits may be for you. Thanks to KØHZI.

Ray Megirian K4DHC
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High Frequency Utility Converter

- - handy test rig for any shack

The simple little HF converter to be described here was constructed out of desperation as well as components normally associated with such things. The utter frustration of not having a converter available to check a new i-f system or the wrong crystal for the right band finally drove me to the brink of a bottomless pit over which, but for the solution shown here, I should have perished.

I did a lot of searching through my collection of magazines to as far back as 1964 to come up with a combination of circuits I thought would solve my problem. The result is a circuit requiring but one crystal and no complicated band switching. It will tune to any frequency from 3.0 to 30.0 MHz and convert it to almost any i-f frequency while employing just three transistors and one IC. You can't beat that with a stick.

Basically, the converter is nothing more than a dual gate MOSFET mixer with a tuned input circuit on gate 1 and a stable conversion oscillator signal on gate 2. The tuned circuit is a multiband tuner which covers the 3.0 to 30.0 MHz range without switching.[1,2] The oscillator portion employs a VCO which is tuned over the range of 8.0 to 30.0 MHz and can be phase locked to a 1 MHz crystal for stability and accuracy. Several articles on phase locked local oscillators have been published and all I had to do was take my pick.[3,4] Of the two I studied, the latter by Kenneth Robbins W1KNI was

The completed converter mounted in its cabinet.

more up-to-date and required fewer parts. I simplified it even more by eliminating some sections not absolutely necessary for a piece of gear that was to be used primarily for testing purposes.

Converter Circuitry

Fig. 1 is the schematic for the converter. Two of the gates contained in an SN7400N TTL IC are used as a crystal oscillator. The remaining 2 gates are used as buffers and are fed in cascade by the crystal oscillator output. Pulses from these last 2 stages are coupled into a pair of detector diodes, D1 and D2, which at the same time are modulated by output from the VCO. The signal from the detector is amplified and filtered by Q1 and associated circuitry to produce a control voltage for tuning diode D3.

In the original article, an agc circuit was included in the VCO section to maintain constant output. I found the oscillator was quite flat over the range I was operating, so the extra leveling circuits were eliminated. An IC buffer between the VCO and the detector and another between the VCO and external circuits were likewise omitted.

As in the original circuit, an adjustable bias is applied to Q1 to keep the collector at the desired operating point of 6 volts. This occurs when .5 mA flows in the collector load resistor. A 1 mA meter was used in the original article as an indicator for setting the bias. I substituted a battery status indicator with a 200 uA movement and shunted it to read 1 mA full scale. A place is provided on the PC board for mounting a shunt if you follow a similar plan. An audio output monitoring point is also available on the PC board if audio monitoring of phase lock is to be used, as was done in the original article. I found it adequate to use the meter for indicating lock.

The mixer is mounted on the same board with the PLL circuits and makes use of a type 40673 transistor. The multiband tuner assembly is mounted separately, as is the tuning capacitor for the VCO. Output from the mixer is untuned with an rfc forming the drain load element.

L1 15 turns #26 on T37-6 toroid. Tap 3 turns from cold end.

L2 36 turns #28 on T37-6 toroid. 2 turn link over center of main winding.

L3 35 turns #30 on T44-2 toroid. 2 turn link over center of main winding.

Table 1.

Construction

The majority of components are mounted on a PC board 2 inches wide and 3.8 inches long. The 2 variable capacitors, the bias pot, the meter, the antenna transfer switch, and the loop interrupt switch are all panel-mounted. The PC layout and artwork for the board I used are shown in Fig. 2.

The variable capacitors for the VCO and the tuner were identical. They had been liberated from transistor radios and were of the solid dielectric type. Each had 4 gangs with 2 sections of 130 pF and 2 sections of 20 pF each. I used the 2 large gangs for the multiband tuner and tied all four sections in parallel for the VCO. Most of the variables of this type do not have gangs of equal capacitance, so you may have to do a little experimenting with whatever you come up with in order to cover the range you want. The VCO is dependent solely on total capacity to determine its operating range, so look for units with plenty of capacity if you wish to cover a wide range. If you are forced to use a capacitor with unequal sections or values different than those used here for the tuner, some pruning of inductors will be necessary to cover the desired range. The low band inductor can be installed first across the larger of the 2 gangs and the response checked to see if it will resonate at the lowest frequency you require. If not, either add or subtract turns until it hits on frequency and then do the same for the high band coil. If either of the tuning capacitors you are using has integral trimmers, set them all to minimum and leave them there.

Total operating range of the VCO will naturally depend on the value of variable capacitor used for tuning. Mine had a total capacity of about 300 pF at full mesh and less than 10 pF at minimum. The operating range was approximately 8.0 to 30.0 MHz. This can be altered as desired by varying the value of L1, the size of the tuning capacitor, or both. Since I used this converter for bands above 80 meters and fed it into a tunable i-f of 3.5 to 4.0 MHz, the above-mentioned range was quite suitable.

It should be pointed out that standard air variables could be used for tuning if space is not a problem. In any case, some sort of vernier drive will be needed, especially for the VCO. In order to connect a drive to the capacitors, some sort of shaft extension is needed. I accomplished this with a 4-40 headless set screw 3/8" long and a 1/4" round fiber spacer with a center hole threaded for a 4-40 screw. A 4-40 tap was run into the existing hole in the capacitor rotor shaft far enough to take about a third of the set screw. The spacer was then threaded onto the

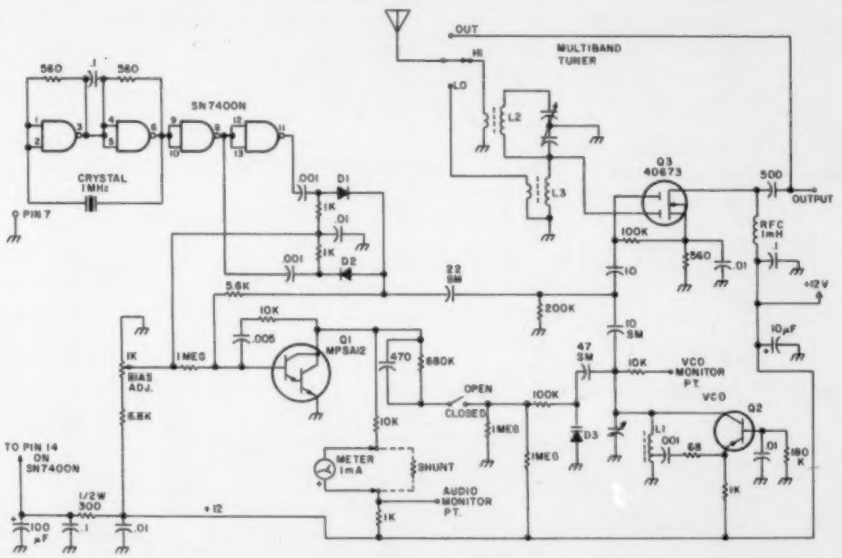

Fig. 1. Schematic for the converter.

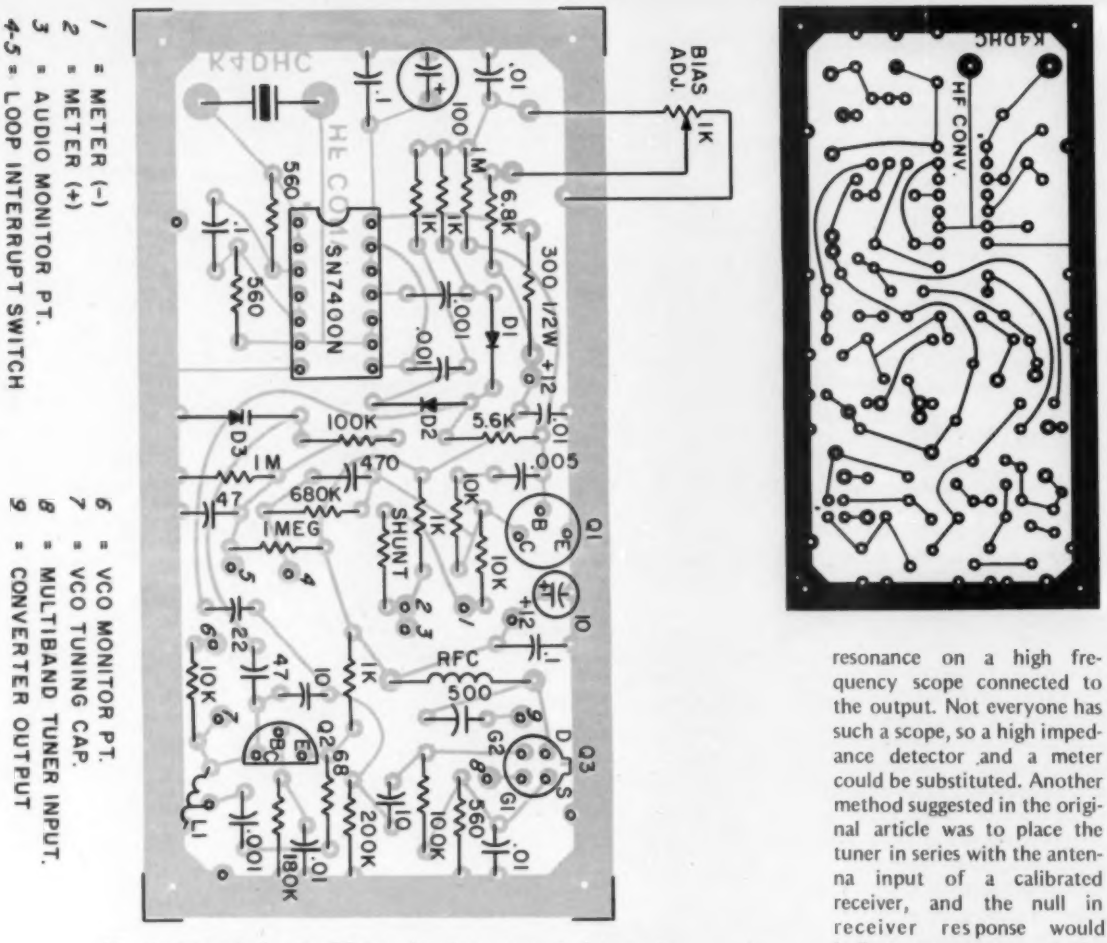

Fig. 2. Artwork for the PC board and component placement drawing.

remaining portion of the set screw to form a perfect 1/4" shaft. These extensions can be seen in the photo.

L1, the VCO inductor, is mounted on the PC board. L2 and L3 are wired directly to the terminals on the associated tuning capacitor with L3 cemented on top and L2 cemented to the back. Connections between the variable capacitors and pads on the circuit board can be made with bus wire for rigidity. Other connections can be made with ordinary hookup wire.

A copy of the front panel layout I used is shown in Fig. 3. The 2 vernier drives were miniature 10:1 planetary types by Jackson Bros. and were built into a standard 3/8" bushing. The pot, toggle switch, and rotary switch were all of the miniature variety so as to fit into the limited panel space. The battery status indicator used as phase lock meter was 1/2" in diameter. The cabinet was a Radio Shack 270-252.

As for choice of components where not specified, I used a pair of germanium diodes of unknown caliber for D1 and D2. The popular silicon 1N914 should work well here too. For the tuning diode, D3, an epoxy "bullet" rectifier diode worked best. Here again, there is room for experimenting and you might even want to try a real varactor diode if one is available.

The PNP VCO transistor I used was house numbered so I don't know the type, but just about any high frequency unit should be satisfactory.

All resistors are 1/4 Watt except the 300 Ohm dropping resistor which supplies power to the SN7400N IC. This is a 1/2 Watt unit.

The coil data provided in Table 1 is that used here. As mentioned earlier, these specifications will vary with the type of tuning capacitor used. The inductors are all wound on toroids and I used what I had available. Some substitutions as to mix and size can be made to harmonize with the inventory in your junk box.

Operation and Adjustment

Calibration of the VCO dial and the tuner dial are the first things to be done. I used a signal generator to feed into the tuner and observed resonance on a high frequency scope connected to the output. Not everyone has such a scope, so a high impedance detector and a meter could be substituted. Another method suggested in the original article was to place the tuner in series with the antenna input of a calibrated receiver, and the null in receiver response would indicate resonance of the tuner at the frequency indicated on the receiver. By whatever means you choose, mark off the frequencies of interest to you for both the high and low bands on the tuner.

Pad 6 on the PC board is a VCO monitor point. Here again, I used my scope to check frequency, but when this is not possible, a counter might be used or a well-calibrated receiver. The turns on the inductor may be spread or bunched together in order to shift the operating range of the VCO a fair amount if needed. When you finish calibrating, it would be best to cement the coil to insure stability.

A regulated power supply should be used to provide the operating potential of 12 volts. It might also be a good idea to check the voltage level

at pin 14 of the SN7400N to make sure it is between 5.0 and 5.5 volts. Some ICs may draw more or less current than others and require a different dropping resistor.

One consequence of operating a VCO over a broad frequency range is the drastic change in the ratio of varactor capacitance to tuning capacitance which occurs as the circuit is tuned over its operating range. At low frequencies, the diode capacitance is swamped by the variable capacitor, and hence the diode has very limited control over the frequency. At the high end, the diode dominates the tank circuit capacitance and exerts far more influence over resonance than the tuning capacitor. All this means is that at the lower frequencies, lockup is far more subtle and requires careful adjustment, while at the high end, just the reverse is true. The VCO snaps in with a vengeance on the higher frequencies. Lockup can also occur at fractional intervals and such points become more pronounced as frequency is increased.

During actual operation of the converter, the technique employed for setting the VCO is quite simple. First set the VCO to the desired frequency with the loop open. Adjust the bias for mid-scale reading on the meter and close the loop. Carefully search for lockup around the desired frequency. As you get close, the loop will capture the VCO and the meter will make a rapid excursion either up or down. Once lockup occurs, the meter will follow any slight tuning shift of the variable capacitor. You can also tell by listening to the receiver whether or not the VCO is locked. If you are operating on a whole number frequency, a birdie will be heard at any whole number dial setting of the receiver. If phase lock has not occurred, you'll hear all kinds of birdies up and down the band. Don't forget to check the bias whenever changing VCO frequency.

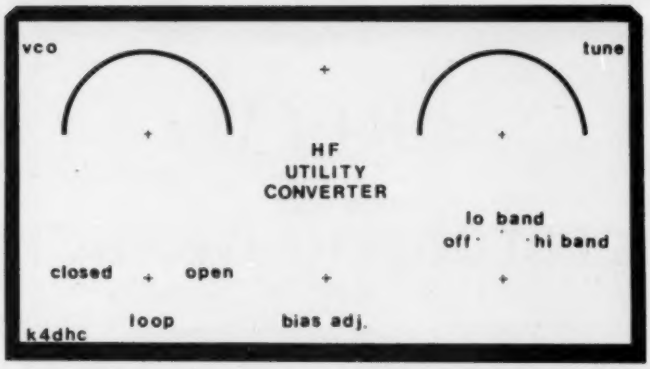

Fig. 3. Full size front panel artwork for the author's model.

With my 3.5 to 4.0 MHz tunable i-f, I set the VCO to 11.0 MHz for reception of the 40 meter band. For 20 meters, I have a choice of either 10.5 or 18.0 MHz. For 15 meters, either 17.5 or 25.0 MHz can be used. For 10 meters, I set the VCO to the low side since my unit stops at about 30.0 MHz. Since operation of both the VCO and the tuner is continuous between the abovementioned ham bands, you can set things up to listen to any portion of the spectrum in between.

Just for kicks, I found I could lock the VCO at 23,250 MHz and tune the CB band from 26.75 to 27.25 MHz using my 3.5 to 4.0 MHz i-f.

Conclusion

As I've tried to point out, I consider this converter more of a tool or test instrument than any kind of permanent receiver accessory. As such, it has no rf stage, the selectivity is limited, and no measures were taken to reduce spurious signals. You will find fairly strong birdies every MHz on the receiver and, if the VCO is set at a fractional frequency, it will cause a corresponding birdie in the receiver. For real serious listening, a more practical approach would be called for, including shielding, filtering, and an rf stage with bandswitching. Just the way it stands, however, I've gotten more use out of this gadget than any other tool on my bench. Have fun! ■

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[3] E. J. Kirchner VE3CTP, "A Phase-Locked Oscillator for Advanced Receiver Design," *CQ Magazine*, September, 1966, page 38.

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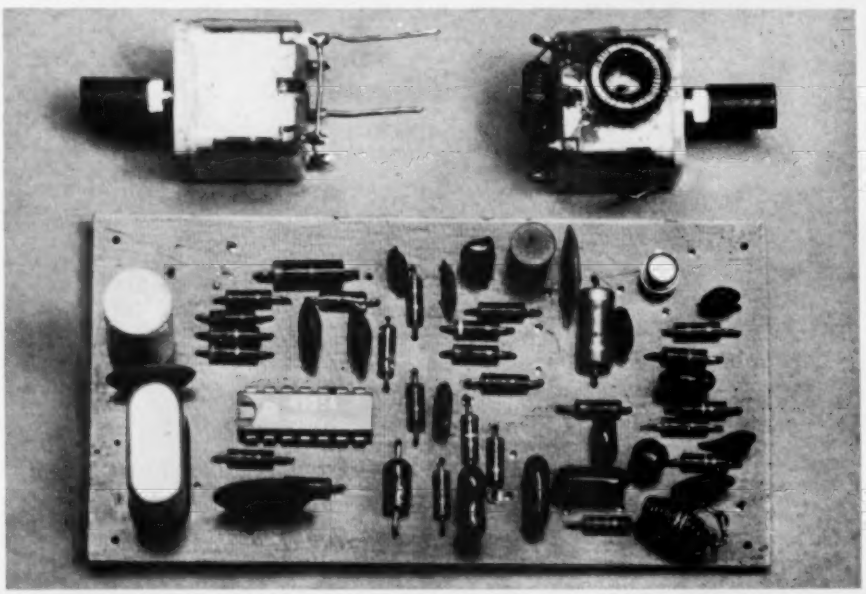

A top view of the assembled PC board. The 2 variable capacitors have extension shafts in place.

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RTTY Scratchpad Memory

-- after this, try a UART

This article describes an erasable RAM memory for RTTY application. The memory is meant to be capable of storing 2 teletype lines (128 characters) of Baudot characters and reading them out at machine speed.

Thus amateurs who do not have a tape reader may type and store a message and play it an infinite number of times. The memory content may be erased and changed as desired as it is "volatile" – it disappears as the power is switched off and may be overwritten. If a fixed message is also desired, a ROM may be programmed and added or substituted for the RAM.

The RAM memory is substantially cheaper, but less flexible then the FIFO type memories such as used in the UT-4.

The circuitry is designed for use in combination with a UART (e.g., UT-2), but may be easily converted to run without it.

Principle of Operation

The heart of the memory system is a 1024 bit static RAM and its appropriate addressing logic.

To write into the RAM, a proper baud rate clock (e.g., 45.45 Hz) is enabled to advance a chain of SN7493 binary addressing counters by 8 per Baudot character. Synchronously, the start bit (1), character bits (5), and stop bits (1-1/2=2) are read serially into the RAM data input. Thus, a 1024 bit RAM can store (1024/8) 128 Baudot characters. To read the memory content, the binary addressing counters are clocked at baud rate, and the RAM content is displayed serially at the data-out pin of the IC. Means are provided for multiple or single read cycles, resetting, and displaying the half and full cycle memory address with an LED indicator.

Circuit Description

IC1, a 555 timer, is used as a master clock. If used for both, the RAM plus a UART, it should run at 16x the baud rate. If used for the RAM memory alone, it should run at the baud rate (e.g., 60

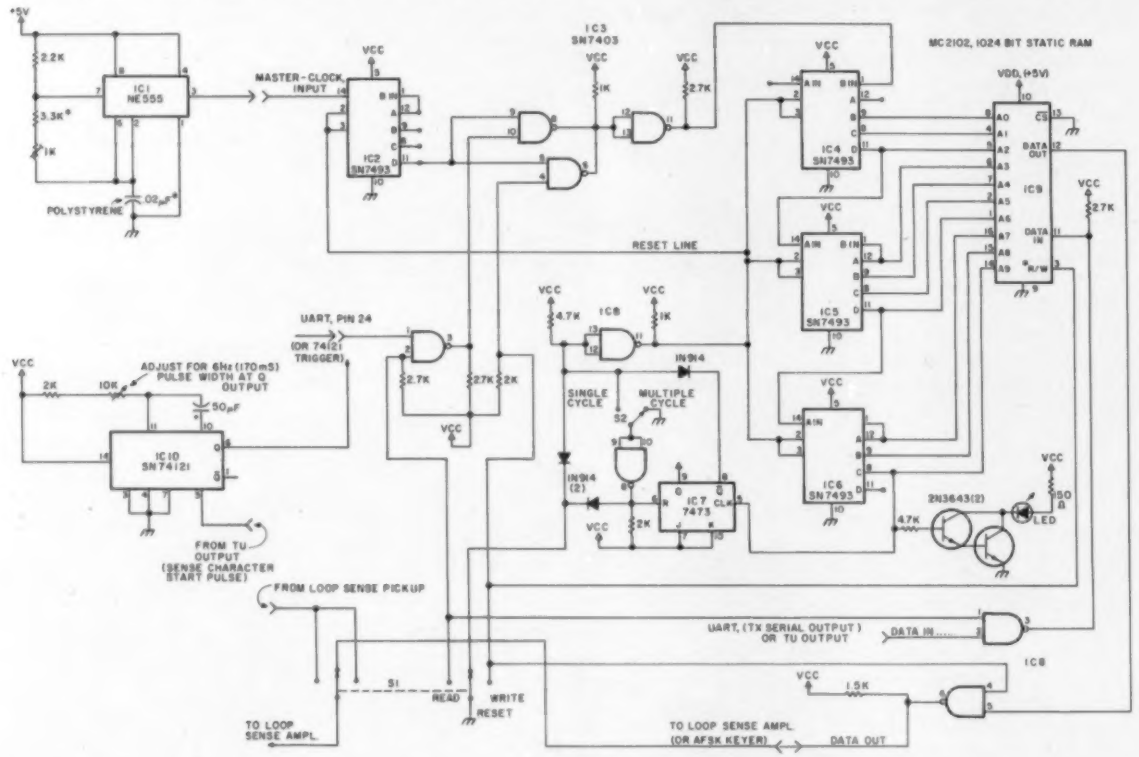

*Fig. 1. Master clock. RAM memory board, for Baudot type RTTY character storage. *Values shown are for 728 Hz (16 x 45.45 baud). **Note: low = write; high = read.*

wpm = 45.45 baud). IC2, an SN7493 4 bit binary counter, may be deleted since it only attenuates the clock speed from 16x to 1x. It is only needed if the clock is used for a UART circuit at the same time. IC3, an SN7403 NAND gate, enables and disables the clocking of the binary SN7493 addressing counters (IC4,5,6) for the RAM. These gates enable the clocking of IC4,5,6 for the duration of 1 Baudot character, that is, they advance the addressing counters by 8, and therefore enable the sequential writing or reading of 7-1/2 (8) bit Baudot characters. There are 2 unused counter outputs, which may be used for the addressing of 2 further RAMs. IC7, an SN7473 flip-flop, decodes a stop pulse when the RAM has cycled through all addresses. One half of IC8, a 7403 NAND gate, provides the switching for "reset" and "multiple" or "single" RAM cycles. The other half of IC8 serves as data input and output buffer. Transistor T1 switches an LED indicator "on" at the half cycle mark and "off" again at cycle completion, thus providing some indication of the cycle status.

If the circuit is not used in combination with a UART (e.g., UT-2), the IC3 gates must be switched from an alternate trigger circuit. An SN74121 monostable flip-flop, with an accurately calibrated time constant of (1/7.5 x baud rate), may be used to decode the start bit of a character and activate the clocking gates (IC3) for 7-1/2 (8) counts.

The RAM scratchpad has been used at my station for several weeks. I use it to loop CQ messages or for copying and replaying a couple of lines of my partner's RTTY transmission.

The circuitry fits easily on a 3-1/2" x 5" board, and the components were purchased for about $8 from James Electronics, California. ■

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Build This CW Filter

- - darned good

To eliminate the frustrations of QRM and avoid the high cost of crystal filters, many hams employ audio filters. Usually, these take the form of passive networks which are often lossy and may require hard-to-get inductors. They are also virtually impossible to tune at these frequencies.

Such problems can be solved through the use of active filters. The filter shown in this article is a single-section, parallel-tuned configuration which uses a negative impedance converter, or "gyrator," to replace the inductor. Basically, the gyrator's input impedance is the inverse of a reactance placed in its circuit. In this case, a capacitor C_L is gyrated from 0.0332 uF to an effective inductance of 1.87 henries. Values up to 100 henries and Qs over 200 are possible with this circuit. Unlike passive filters, this has a 6 dB gain at resonance and virtually a zero Ohm output impedance. The circuit shown has a bandpass of 85 Hz centered at about 865 Hz. With the transformer shown, the op amp can provide plenty of volume to drive headphones. It operates from a single supply of 12 volts but can be used with a dual supply (e.g., two 9 volt batteries). Circuit Q is controlled entirely by R_S, which may be made switchable to provide various bandwidths. Provision can also be made to tune the filter with a single potentiometer. C_L and C_T should be fairly high quality mylar or polystyrene, and the four resistors, R, should be matched to about 2%. Nominal values for R_S lie between 50k and 300k. Approximated design equations are shown in Table 1. ■

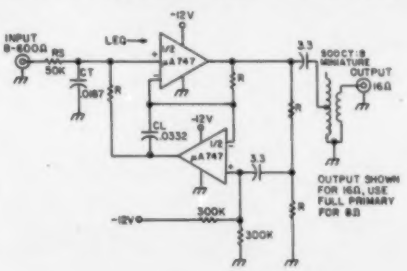

Fig. 1. Schematic. 850 Hz filter. R—7.5k.

$$Q = FR/BW = 2R_S/(2\pi FR \cdot L_{EQ})$$

$$L_{EQ} = R^2 C_L$$

$$FR = 1/(2\pi\sqrt{L_{EQ} \cdot C_T})$$

Table 1. Design equations.

Originally published in Ottawa Amateur Radio Club Bulletin, *The Groundwave*, April, 1975.

73 Magazine *Staff*

The London Bus Tuner

- - effective for short antennas

A better, but less interesting, title for this article might be "a programmable, compact, medium power antenna matching device." The London bus comes into the affair because in searching for a way to inexpensively house an antenna matching network, we recalled the ticket dispensing machines used by attendants on the London buses — a machine which they carry with a large knob on one end.

One of the problems in housing any medium to high power antenna matching circuit, especially one using a rotary inductor, is that the construction cost starts to soar quite rapidly if one is forced to use a conventional large enclosure and a front panel turns indicator for the inductor. On the other hand, the use of a continuously variable inductor is superior to a fixed, tapped inductor if one wants to have a matching circuit which will accommodate a wide range of impedances on any HF band. This article mainly presents a few construction ideas and suggestions for housing a wide range antenna matching circuit at reasonable cost. Dimensions are given for one specific circuit, but they can be scaled up or down depending on the specific components used.

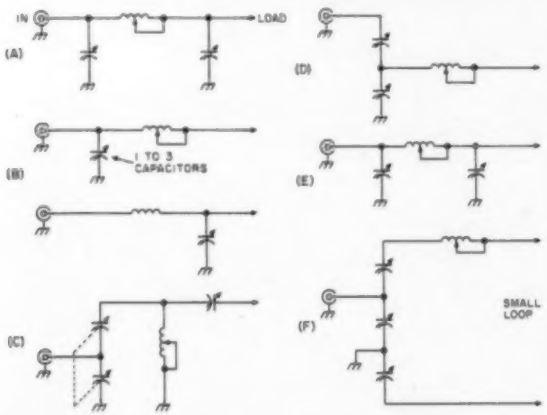

Fig. 1. These are some of the matching networks that can be formed by the interconnection of four "floating" components — a variable inductor and three single section variable capacitors. Component values are discussed in the text.

The circuit described in this article consists of just four floating components — three variable capacitors and a variable inductor. By keeping these components above ground and providing for their internal interconnection (programming), a variety of matching circuits can be formed as shown in Fig. 1. Each form can have its particular advantage, depending upon which band from 160-10 meters is being used and what form of antenna one is trying to match. The circuit possibilities range from simple L networks to a "transmatch"-type circuit. Besides matching networks, the components can be interconnected to form simple one section low pass, high pass, or trap-type filters for experimental purposes. This flexibility is often useful when one wants to quickly set up a trap or other type LC circuit for experimental work in a transmitter or receiver.

The inductor used is a standard Johnston 28 uH unit. Various surplus types of the 18-33 uH size, such as from the Command Set series, are also usable. In fact, it often pays to buy one of the old transmitters just for the rotary inductors! With 300 pF capacitors rated at 1500 volts, just about any antenna form can be handled up to the 500 Watt level from 160-10 meters. With 100 pF, 2000 volt units, a kW can usually be handled from 80-10 meters. Towards the other end of the scale, if one is using a barefoot rig of the 150 Watt category, the use of the reasonably priced and more readily available Hammarlund MC325M variables (325 pF, 1000 volt) is a good choice for 160-10 meter capability.

The whole subject of finding variable inductors and capacitors at "amateur" prices for anything above the QRP level could develop into an article by itself. About the best that can be said is that bargain hunting still pays off. For instance, all the electrical items for a 500 Watt level matching circuit could be found for $18 at Fair Radio, PO Box 1105, Lima OH 45802. The items a surplus house has in stock are in a constant state of flux, but usually something suitable can be found. Don't overlook the old BC-191/BC-375 tuning units and the previously mentioned ARC-5 (Command Set series) transmitters. They often are available at reasonable prices, although the variable capacitors/inductors have odd shaft sizes and call for a slight bit of mechanical ingenuity to use.

A matching circuit using a 28 uH rotary inductor and three 100 pF, 2000 volt capacitors was housed in an inexpensive 9 x 6 x 5 inch enclosure (Bud CU1099). The inductor was placed parallel to the long side of the enclosure. The turns counter assembly is simple but effec-

tive (see Fig. 2). A 5 digit left-hand drive veeder root count (Burstein-Applebee #18A1507-3 at $1.49) has its ½" belt drive wheel driven by a 2" belt drive wheel placed on the rear shaft extension of the inductor. The 2" drive wheel and rubber belt used were junk box tape recorder parts. The counter reads from 0 to about 600, and this is enough accuracy to ensure resettability to a fraction of a turn. Many other similar mechanical turn counters can be used.

The three capacitors were directly mounted on an approximately 8 x 2 inch piece of plexiglas. This plexiglas plate was mounted to the panel of the enclosure with regular metal hardware with about a 1½" standoff from the panel. Insulated shaft couplings were used on each variable to complete its insulation from the enclosure. Leads from each component (# 16 or # 14 hookup wire) were routed to a long barrier terminal strip (similar to Radio-Shack 274-670) mounted on the rear inside panel via an insulating piece of plexiglas. Short pieces of wire with spade lugs at each end are then used to interconnect components as desired. Only two SO-239 coax receptacles show on the rear outside of the enclosure. One could, as an alternative to the above, bring out each component to binding posts on the rear panel. But, since high rf voltages may be encountered, this would require that the posts be mounted on a piece of plexiglas which in turn is mounted over a cutout in the rear panel.

If one has some pre-knowledge of the impedances to be matched, a specific matching circuit configuration can be used immediately. Otherwise, the pi-network of Fig. 1(a) or the circuit of Fig. 1(c) are always good ones to start with. Note that the "transmatch" circuit of Fig. 1(c) normally uses a dual variable, so the two single variable capacitors used instead have to be simultaneously rotated to simulate a dual variable. One can then try other matching configurations to achieve the best transfer of power. Generally a good rule of thumb is that the matching circuit which uses the *minimum* amount of inductance to match into the load *and* which provides a clear swr minimum on the coax line between the transmitter and the matching circuit will be the most efficient circuit to use. To see which circuit does this is easily facilitated by logging the turns counter readings for the variable inductor. ■

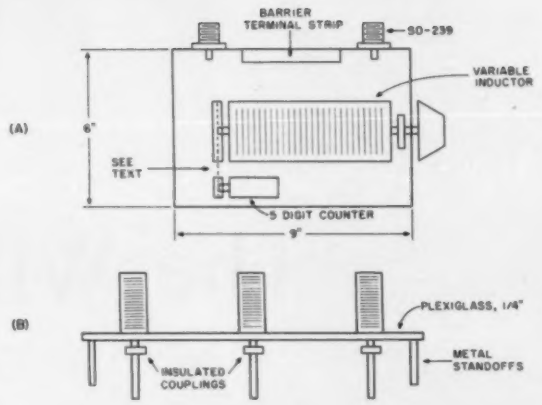

Fig. 2. Compact construction of a medium power tuner in a 9 x 6 x 5 inch enclosure. (a) Top view without capacitors. (b) Capacitors mounted on a plexiglas strip, which in turn is mounted above the variable inductor by standoffs to the front panel. Details are in the text.

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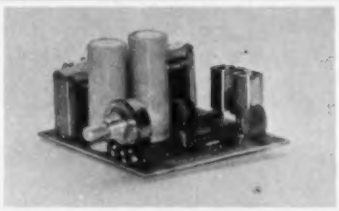

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Rich Force WB1ASL
Publications Editor

The WIBB Story

-- a visit with the king of 160

What started out as a simple journey to Winthrop, Massachusetts, for Stan WA1UMV and me, to take a picture for the cover of 73's new publication about the 160 meter band, *The Challenge of 160 Meters!*, quickly turned into one of the most interesting days I have spent since becoming involved with amateur radio.

W1BB and the author atop one of Stew's towers. The tower was built in the 1930s and is located atop the house on Pleasant Street, Winthrop MA. Stew is indicating the way to Europe.

What, you may ask, were we doing in Winthrop MA to take a picture for a book about 160 meters? Winthrop is the home of 160 meters' most distinguished and recognized enthusiast, Stewart Perry W1BB.

I spoke to Stew by phone a few days before, and he invited us down to take a picture of some of his prize QSL cards. The cards were those he had used to obtain the first DXCC certificate issued exclusively for 160 meter operation.

As we drove up in front of Stew's house, it was not hard to recognize it as the home of an avid ham. Besides the numerous antennas on the roof of the large Victorian two story home, there was a convertible parked in the driveway which carried a whip antenna with the largest loading coil I've ever seen. In fact, the cover for the coil was made from an inverted plastic trash pail. On the pail was written W1BB/160.

We were greeted at the door by Stew W1BB, a very distinguished looking gentleman, who escorted us to his ham shack on the second floor.

As we walked into the room, it was like taking a step back in time. There in front of us was the shack of yesteryear – the type of place you would visualize when reading about the early days of radio. Yet intermingled among the vintage equipment was a modern up-to-date amateur station.

Stew explained that this station was just one of three he operates. It, however, was the oldest, and most of the visible equipment was built around 1935. He had at that time built transmitters for every band from 160 through 2 meters and could, through a series of patch cords, QSY from one band to another in a matter of seconds.

He demonstrated his first transmitter for us. It was a spark unit, and the noise was deafening. In the corner was a giant knife switch. Stew explained that such a switch used to be required for lightning protection, and this particular switch was used to ground his 160 meter doublet (which was fed with 600 Ohm open wire line). Next to it was an allband tuner which employed three variable capacitors, plug-in coils and an rf ammeter in each feedline leg.

Stew's two other stations consisted of a smaller station

in his bedroom for those late night openings and a larger station at the site of the Winthrop water tower, where, in addition to operation for the Winthrop Emergency Radio Net, for which he is radio officer, Stew has permission to conduct some of his 160 meter tests. The tower braces Stew's 160 meter inverted vee beam 265 feet above the ocean's surface.

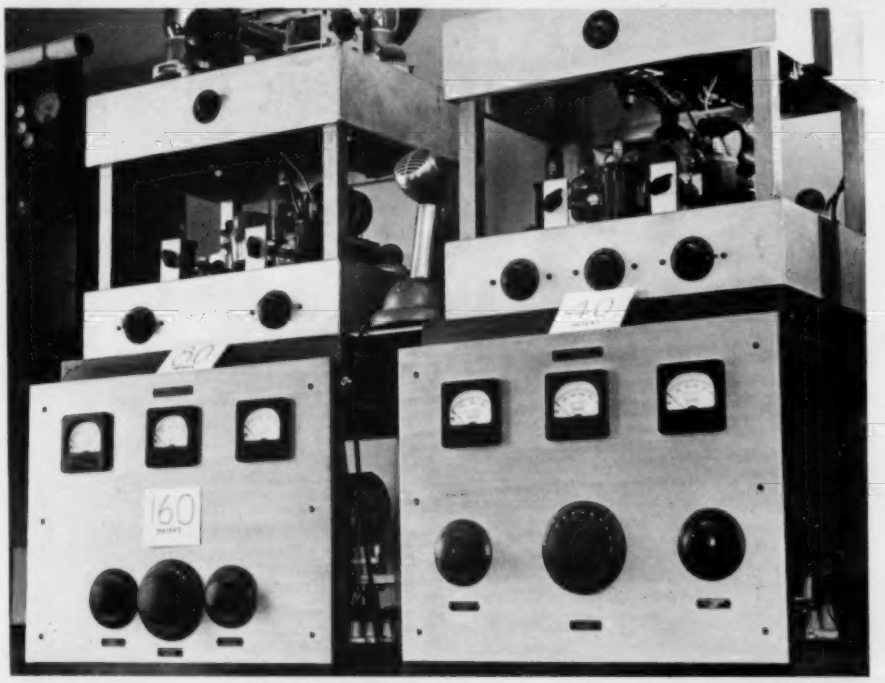
While Stan took pictures of the shack and QSLs, Stew and I went into the kitchen, where, over a cup of coffee, I found out how Stew Perry W1BB had, over a period of 65 years, come to be one of the best known and respected gentlemen of the "gentlemen's band."

The Perry family has lived in the same house on Pleasant Street since Stew's birth in 1904. When Stew was 8 years old, his interest in radio was kindled by a neighbor. As he tells it, one day he was playing in his backyard when his next-door neighbor Eddy O'Toole, who was always interested in scientific things, called him over to show off his new crystal radio. Stew listened and heard dots and dashes. Eddy explained they were coming from the Boston Navy Yard (NAD) and were talking about a large ship which had recently sunk. Well, the ship turned out to be the Titanic, and the incident was the start of Stew's interest in radio. Of course he wanted to make a radio, and Eddy told him how to do it. All he needed was a Quaker Oats box, some wire, a slider, and a galena crystal. So he went to Bin's Radio in Boston and purchased the materials, and it wasn't long before he was listening to NAD.

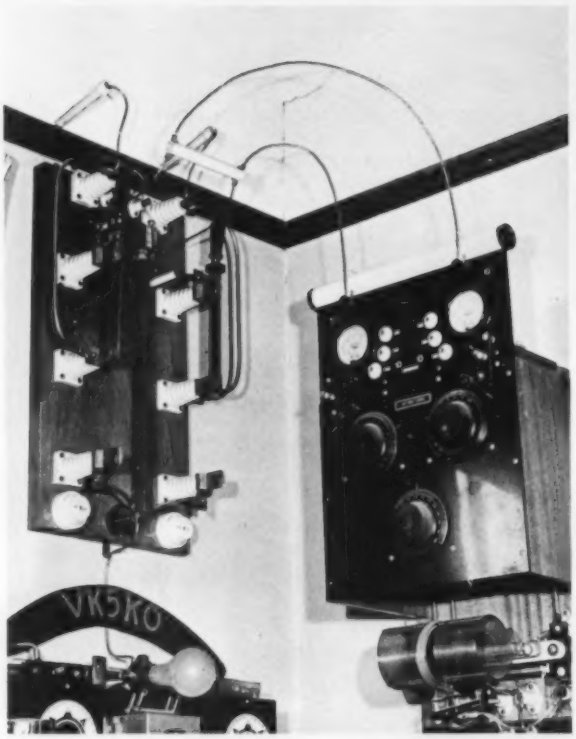
It was right after this that Stew managed to obtain an old Ford spark coil and get on the air himself. In those days, no one had a license, he explained, and he signed the call SS, which are his first two initials. Stew thinks they were operating somewhere around 500 meters, but no one really knew the exact frequency. The estimate was based on NAD, which used to call Stew once in awhile to ask that he QRT because he was interfering with them. They were operating near 500 meters. The first contact Stew had was with Eddy O'Toole, his next-door neighbor, which was followed by others with people in the neighborhood.

After a while, licenses started to be issued for radio operation. And as Stew puts it, "Those with licenses would squeal on those without them." So he decided to get one. He went to the Customs House in downtown Boston and took the test. It consisted of a 5 word per minute code test, which you had to pass before taking the written exam. The written part was all essay-type questions and covered theory, rules, and regulations. One part of the exam was to draw a complete diagram of a station, including a receiver, transmitter, and antenna system. Another question was to explain how radio frequency waves were generated, starting at the power lines and ending with the antenna. Other questions dealt with

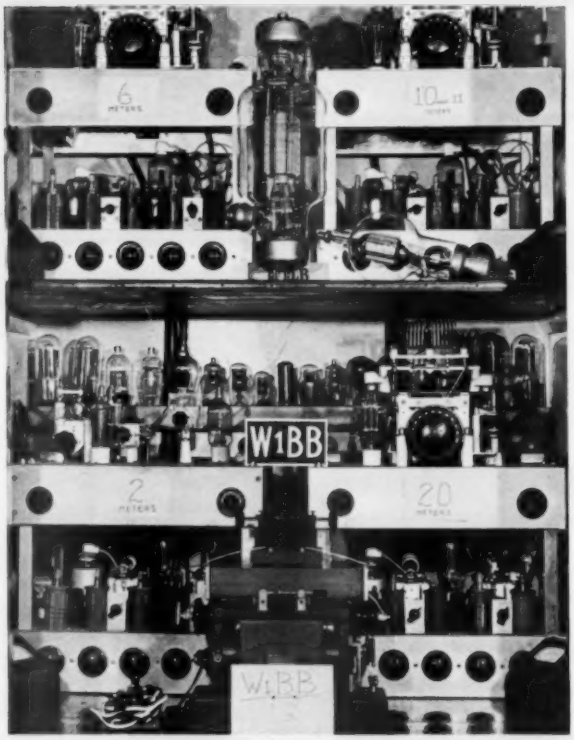
Whip antenna mounted on W1BB's auto. The loading coil is covered with a plastic trash can. Stew worked mobile on 160 meters for over 25 years, using both AM phone and CW.



Several of W1BB's transmitters built circa 1935. These transmitters could be switched from one to another in a matter of seconds.



The large knife switch in the corner of W1BB's station on Pleasant Street. The switch was used to ground his 160 meter antenna for lightning protection. Next to the switch is an allband antenna tuner.



Some of W1BB'S switchable transmitters built around 1935, as well as his spare tube collection. In the forefront on the bottom shelf is one of his original spark transmitters from 1912. A demonstration proved the noise from this unit to be deafening.

such things as Leyden jars and mud capacitors. Stew said it was an easy exam if you knew about radio. As luck would have it, he passed the exam on the same day war was declared – the beginning of World War I. He was issued his operator's license, but not a station license.

After the war, word came down that station licenses were to be issued. Stew thought that it would be nice to get 1AA (at that time W prefixes were not used), so he got up at 4 o'clock in the morning and went to the Customs House only to find that others had the same idea and were already in line. As it turned out, he was issued 1BB, which he has held ever since.

At that time hams were given the frequencies of 1750-2000 kHz, the forerunner of today's 160 meter band. According to Stew, they used to try to operate as close to the bottom of the band as they could but the spark transmitters were so wide that a signal on 160 meters could be heard from 100 meters to 250 meters. Hams tried to sharpen their signals by using a helix auto transformer, which consisted of a tank coil of about 15 turns and a variable link of about 7 or 8 turns, but it did not help very much. Signals were never sharp until the advent of the vacuum tube.

While it was illegal to operate during World War I, Stew studied and managed to obtain his commercial radio license. As a result of this license, in 1920 he went to sea as a commercial operator, operating in the 500 meter band. His life at sea was to last, on and off, for the next six years.

In 1932, the 160 meter trans-Atlantic tests began. These tests were sponsored by a group of British hams, including G2II and G2PL, and were conducted every Saturday morning at European sunrise. American hams would call for the first five minutes past the hour, and then listen while the European hams would call for the next five minutes. When a contact was made, the calling schedule would stop. At this time no one thought of counting countries – just getting a trans-Atlantic contact was excitement enough.

After the tests had been conducted for a few years, hams did start counting countries. In 1935, W1BB listed Belgium as country number 1, after receiving a QSL from ON4NU. Others also started counting, including W1LYV, W2IV and W2EQS.

By 1968, 33 years later, Stew had confirmed his 100th country with a card from CE3CZ in Chile. He now has 139 confirmed on 160 meters alone.

Stew says it's now easier to work DX on 160, due to the fact that more is known about the band. We have better antennas and better receivers, and propagation is better understood. For example, in the beginning no one considered opening during American sunsets. All DX was worked during European sunrise. But now it is known that the band also opens for a couple of hours after the western sunset. Antennas have also changed. Early hams used Zepps and horizontal doublets. Now we find that verticals, inverted vees and inverted L's work better as transmitting antennas. Also, it is now known what countries can be worked on 160 and schedules can be made.

As to the type of antenna Stew would suggest for 160 meter work, he says an inverted L type with a good ground system is the simplest. And he stresses a *good ground system*. The inverted

L, he explains, is nothing more than a top-loaded vertical. In stressing the point about the ground system, he uses the example of ZE7JX, who needed to work Australia. He started with a few ground radials and kept adding more and more. Before he achieved his goal, he had buried more than 16,000 feet of wire but had kept the antenna the same. Stew has a ground system which he installed in 1940. It consists of 7' X 4' zinc plates, connected together like the spokes of a wheel, with the antenna in the center.

As for receiving in a quiet area, a resonant antenna such as a sloping dipole or a vertical is suggested by Stew. However, in a noisy area the beverage antenna is best. A beverage antenna is a long long wire terminated with a resistance for directivity. It is run close to the ground and does remarkably well. Experiments have also been conducted while running the beverage antenna underground and underwater. Stew has used an underwater beverage with a length of 150', 6-7' below the surface. He says the results were spotty. KV4FZ has achieved great success with an underwater beverage 300' in length, 4-6" below the surface.

Stew sees a bright future for 160 meters, marked by increased activity. As long as the newcomers abide by the unwritten rules and observe the "DX window" (an area historically reserved for foreign stations from 1825-1830 kHz), the band should offer many hours of enjoyment to hams.

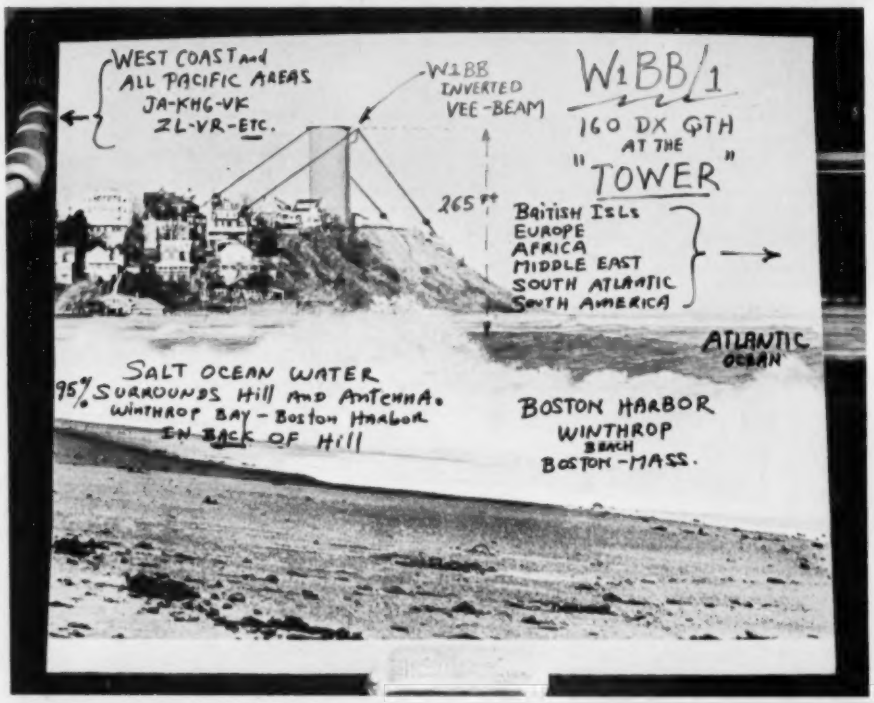
Aside from his accomplishments on 160 meters, Stew also works other bands and has the capability of going on any band from 160 to 2 meters. He seems to work 20 meters the most, often checks into 80 meter nets, and gets on 40 occasionally.

Stew's reaction to the recent FCC proposals to be offered to WARC is that they look very well thought out.

Stewart Perry W1BB, whose station has been in use since 1912. Stew holds the first DXCC issued for exclusive 160 meter operation.

He was surprised to see that they proposed the 160 meter band go back to its original starting point of 1750 kHz. He had hoped that the band would be left as it stands (but with the elimination of Loran).

To express how a shift in



W1BB's secondary station location, showing the position of his inverted vee beam strung from a water tower 265 feet above the Atlantic Ocean.

frequency makes a dramatic change in the propagation of signals on the 160 meter band, Stew relates the story of HB9CM. It seems that HB9CM was working a stateside station on 1827 kHz and received a signal report of RST 449. He decided, for experiment's sake, to go up to 1995 kHz to see if his signal strength would change. He came up to an RST 579. And that, Stew says, is sometimes the difference between the top and bottom of the band when the MUF is just right. "And," he adds, "we used to all try to stay as close to the bottom of the band as possible. In those days, it was thought the lower frequencies were the best for DX."

As to the proposed 1875 meter band which the FCC will include in its recommendations to WARC, Stew does not see it being anything like 160 meters. He thinks the band, if it is ever approved, will be more akin to two meters in its range and application.

After concluding my discussion with Stew, we all departed to the site of his station at the Winthrop water tower. Standing on top of the cliff next to his two element inverted vee beam antenna 265 feet above the Atlantic Ocean, Stew stretched out his arm and said, "That way's Europe." He moved his arm and said, "That's North Africa." He moved it a little more: "And that's South Africa." It was a site to make any DXer's heart green with envy. Here was a man who did what many had thought was impossible. He managed to be the first to work 100 countries on 160 meters, after 33 years of operation. For Stew, though, I'm sure it was not hard, because he enjoyed every minute of it. It is only right that a person who feels so much good for something should excel at it. He is a real gentleman from among those on the "gentlemen's band," 160 meters.■

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ETO considers these FCC proposals damaging and unfair to amateur radio, as well as unlikely to accomplish their intended purpose. But as this is written, it nevertheless appears probable that they'll be adopted.

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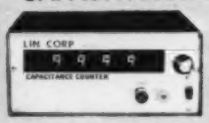

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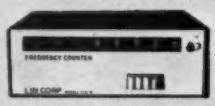

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Ten Watts On 2

-- it's possible with this rock crusher!

An easy to carry portable pack for your two meter FM rig is a great asset for any ham: to keep in touch at work, on hikes, during walk-a-thons or other public service events, and just to have more fun with amateur radio. Fortunately, making a decent and reliable portable carrying case, with self-contained batteries (rechargeable, of course) and antenna, only takes a bit of scrounging and care.

You'll notice that my efforts culminate in a rig that runs *ten* Watts output, not the usual 2 or 3 Watts of other portables. However, it isn't exactly hand-held, nor does it weigh a couple of pounds (the porta-pak tips the scales at 7½ lbs.). But the advantages far outstrip the drawbacks: much greater power output to hit the more distant repeaters reliably, no great outlay of cash for another transceiver (you use your present mobile rig), and the fact that most other hams I've seen carry their HTs on their belts anyway – so a shoulder strap rig is just as "hand-held" as theirs is!

The Rig

The first thing you need is an FM transceiver, of course. My Icom IC-22A is shown in the photos; any of the standard power 10 Watt rigs (Midland, Heath, Standard, Genave, etc.) could work as well. Even if your powerhouse runs 25 Watts out, it may have a low power mode which can be modified to run 5 or 10 Watts. Alternately, a home brew or module-type kit built rig, like the VHF Engineering units, could be made portable this way.

The Case

The case for the rig is a slightly altered cassette tape recorder affair (you used your recorder for slow scan anyway, now here's where the case can come in). It originally measured 28 by 19 by 7.5 cm, obtained at a local flea market for less than $2.00. These things are usually vinyl covered cardboard, stitched up as in the photos, and are surprisingly rugged. If you really want to be creative, have your local sweet young thing, wife, or even yourself throw together a custom job out of leather. Be sure to put a strap on it so you can sling it over your shoulder – and don't forget to leave room for the batteries!

The FM transceiver, in my instance, was a bit too large for the cassette carrying case, so I extended the cover flaps and used velcro as a securing device. Velcro is that material with zillions of little hooks on one surface and an equal number of loops on the other so that when you press the two together, they stick. A couple of small pieces (20¢ at the local fabric shop) hold very tenaciously and can be sewn, glued, or stapled to the case. Velcro is much easier to use and is just as strong and reusable as snap fasteners or buckles and straps. Besides, it makes that satisfying "rip" when you go to open the case.

Batteries

The rig sits on top of the battery pack, as you can see in the photos. This nicad pack has ten "D" size cells all strapped together and puts out 3.5 Amperes for a solid hour. With 150 mA receive current (all dial lamps on) and 2.2 A transmit draw for 10 Watts output, the pack runs all day and night in regular service without a recharge. If you don't want the rig to sit on top of the batteries, you can lay them end-to-end alongside the transceiver inside the case. Hopefully, you'll find a case thick enough for this – but mine worked great with the batteries at the bottom.

"C" size nicads will last nearly as long on a charge, but you'll be working them harder and they may poop out just when you need them most. Alternate energy sources are the newer gel-cell batteries, which have no nicad "memory" effect, and are somewhat less expensive. Lead acid wet cells are usable, and are sometimes available at Olson Electronics, flea markets, and surplus houses. Some battery manufacturers are listed at the end of this article. I imagine that if you could find a small motorcycle battery, it would work fine. A two Ampere-hour rate at one hour is about minimum for useful, long single-charge life from the battery power source.

Connecting the battery to the transceiver is not that much trouble, obviously, but taking a little more time to add a switch and connector makes the porta-pak more versatile. I used a small 3

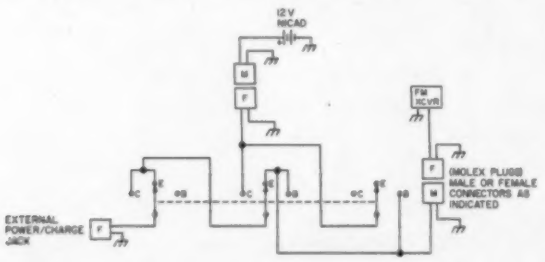


Fig. 1. Schematic of power switching for the portable rig. C – charger goes to jack for charging nicads; E – 12 V power to jack for external supply; B – battery connected to FM transceiver.

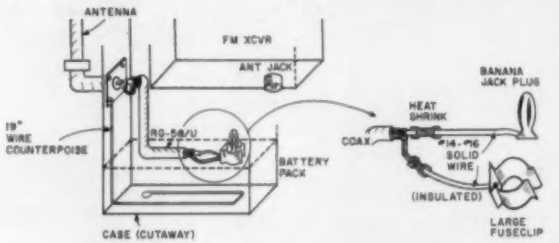
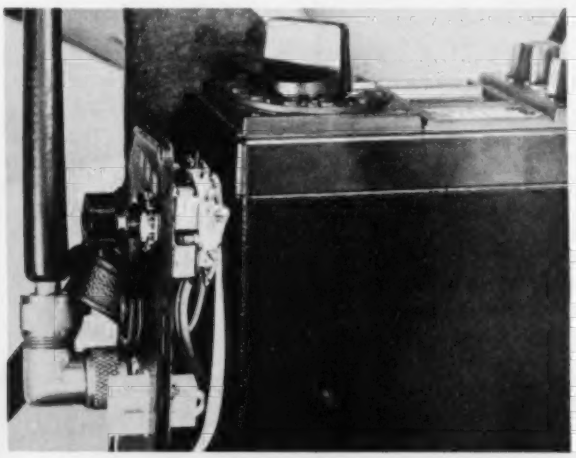


Fig. 2. Diagram of the right angle coax connector and the case with its 19 inch antenna counterpoise.

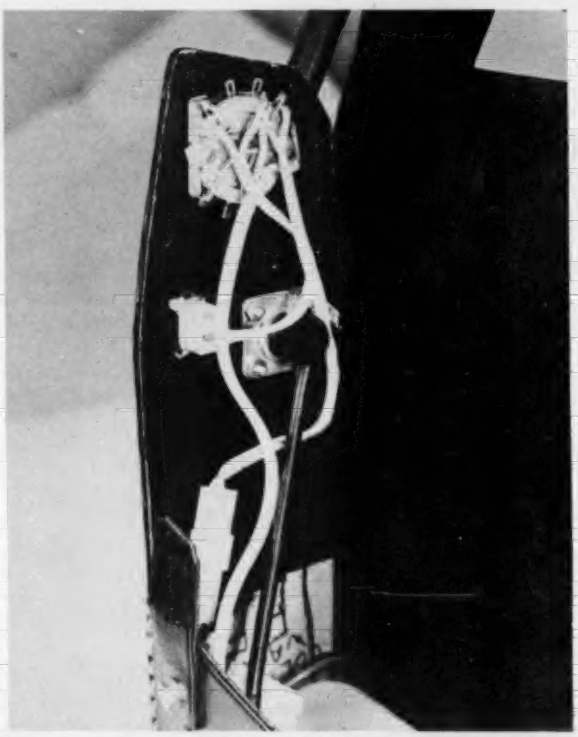
Left-front view showing antenna, power jack, and switch.

Right-front view showing microphone clip.

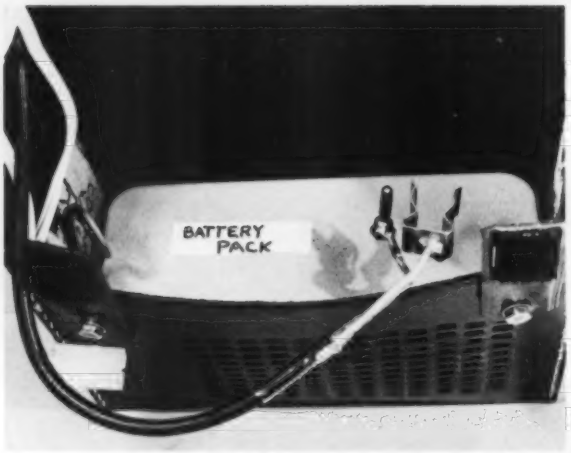
pole, 3 position rotary switch to either connect the rig to the battery, hook the rig to the external power jack, or connect the battery to a charger via the external jack. Fig. 1 shows the switching setup, and the mounting arrangement is visible in the photos. The external power/charge jack can be epoxied to a carefully cut hole in the side of the case, while the rotary switch is mounted conventionally. I suppose that if there were more room in the carrying case, a charger could be built in. However, I found that the 12 volts available at the case's power jack when switched to the "charge" position is useful for running lamps, HF QRP gear, or other equipment from the nicads, without having to remove them from the case.



Close-up with top cover flap lifted.



Power switch and antenna wiring. Notice counterpoise wire running from SO-239 down far inside corner of case.



Coax connector with battery sitting in the bottom of the case.

Close-up of transceiver rear panel with coax connector.

Antenna

The antenna connection is about the most difficult thing to accomplish, since the rig sits upended on the batteries and the antenna jack sticks out of the transceiver's rear panel. Adding a coax elbow and associated connectors made the IC-22A jut too far out of the carrying case, so I made connections to a sawed-off banana jack and an old fuse-clip holder, resulting in a very shallow right angle coax connector. See Fig. 2 and the photos for more information. I found that solid #14 or #16 insulated wire worked best for 1½ inches between the home brew connector and the RG-58/U coax, preventing the flimsy coax braid and center conductor from breaking off at the connector while the rig shifts around slightly in its case. Use heat shrink tubing around the solder joints. At two meters, the connector is a bit lossy (10-15%), but it's the best solution to the problem of keeping the porta-pak as compact as possible.

I mounted an SO-239 antenna jack at the side of the case, and used a coax elbow here so that a rubber ducky, 19 inch whip, or external antenna can be screwed on. When I first used the portable rig, I was disappointed in the results because of the poor radiation efficiency. However, when I ran a 19 inch counterpoise wire from the SO-239 grounded mounting ears down around the bottom of the case, results improved as much as 20 dB! So the whip or helical antenna now acts as the radiating end of a vertical dipole, much more effective than the antenna alone stuck on the end of a short length of coax. Handie-talkie owners might try this trick too, since it really improves signal strengths. The wire doesn't seem to bother anything when the porta-pak is hooked up to an external antenna, since it is connected to the shield of the SO-239.

Results

I've been using my portable ten on two for nearly six months now, and have consistently out-talked and outperformed belt-mounted HTs. I didn't have to lay out $30 for an external mike, either! Once I worked several San Francisco Bay Area repeaters from Yosemite National Park — and was full quieting with the 10 Watt power level (I also had about 5,000 feet of height). I never have to remove the rig out of its case when used in the car or home, thanks to its provisions for external power and antenna. And, there is no problem with car theft — I take the porta-pak with me!

I've been to plenty of club meetings, amateur flea markets, and ham get-togethers with this little system, and if the interest generated in it is indicative of a universal appeal, many more will be built. I hope this article helps with some general guidelines and ideas, so you can more easily build your own 2 meter FM super porta-pak. ■

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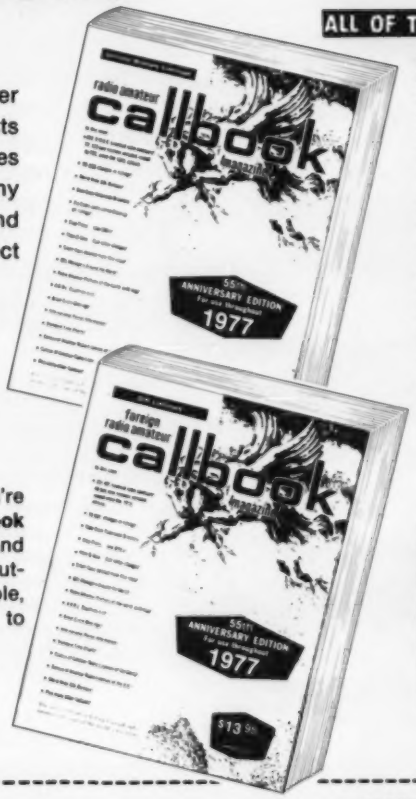

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R1

UHF SWR Indicator

- - 1296, anyone?

W. E. Parker W8DMR
2738 Floribunda Dr.
Columbus OH 43209

The line may be left connected in the transmission line, and the meter box conveniently placed on top of the transmitter.

There are many inexpensive standing wave ratio indicators that are listed as good up to two meters and do function well. At frequencies above approximately 150 megahertz the results leave something to be desired.

There are several valid reasons why the swr indicators are inadequate. In order to have good sensitivity at the lower frequencies (80 meters), the coupling loops used for forward and reflected wave sampling are usually six inches long, and are close-coupled to the center conductor of the transmission line. If the sampling loops are shortened and loosely coupled, then the sensitivity for the lower frequencies is greatly reduced.

Another reason for poor operation is that the coupling loops required for low frequency operation represent almost a quarter wave at the ¾ meter band (≈500 MHz). Distributed capacity between the long coupling loops and the inner coaxial conductor is excessive.

The diode rectifier characteristics become more important at the higher frequencies. The position of the pickup loops with regard to spacing, direction and concentricity must be very carefully aligned if their electrical characteristics are to be as similar as possible. Once aligned or positioned, the loops must remain rigidly affixed if a level of confidence in the indicator is to remain.

If the coupling loop is to be a small percentage of a wavelength (1/20 or about 5 percent), a length of one inch is about the maximum to be considered. If the indicator is to be used with low power transmitters (½ to 2 Watts), the loop should approach the one inch length. For high power transmitters, the loop may be as short as 1/8 of an inch. This is that portion of the loop that is parallel to the coaxial center conductor.

The coupling loops form a circuit with a resistor such that the mutual coupling is positive (+) in one case, and negative (-) in the other. The same effect could be obtained if a single loop was used for sampling, then rotated 180 degrees, and then sampled. Inspection of the equations that follow will show this is taken into account.

That portion of the loop parallel to the center conductor and the resistor form a third component, the distributive capacity element C. See Fig. 1.

The output rf voltage e_o is made up of e_r and e_m. A voltage divider is formed by distributive element C and R.

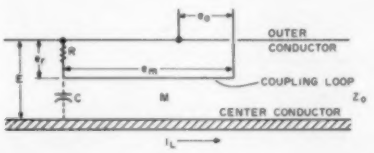
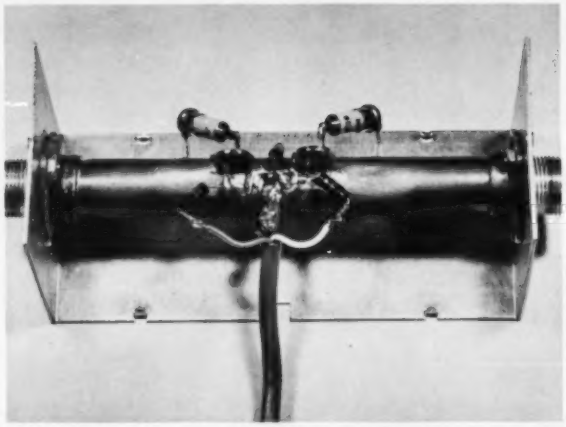
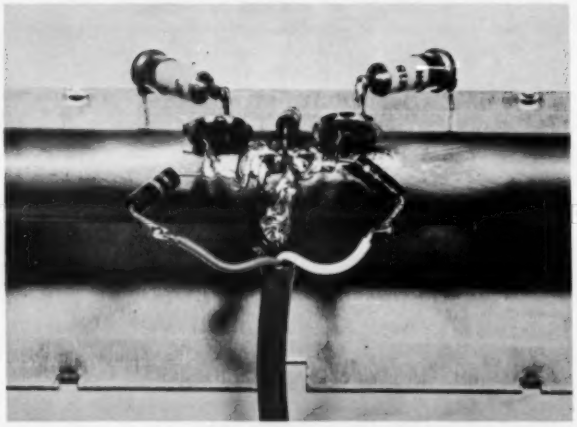


Fig. 1.



The ½ inch copper water pipe transmission line mounted in a minibox with components attached.



The edges of the button bypass capacitors have been soldered directly to the line. The 39 Ohm resistor is in the middle. A heat sink should be used when soldering directly on the diodes.

Then,

$$e_r = \left[\frac{R}{R + X_c}\right] E$$

and if R is much less than X_C,

$$e_r = \frac{RE}{X_c}$$

and since jwC equals $1/W_C$,

$$e_r = REjwC$$

$$e_m = I \left[jw (\pm M)\right]$$

by induction.

The sum of e_r and e_m is (factoring out jw)

$$e_o = jw (CRE \pm MI)$$

The directivity of the indicator, its ability to discriminate between the forward and reflected wave components, depends upon the relationship $CR = M/Z_O$, where Z_O is line impedance.

Substituting for CR,

$$e_o =$$

$$jw \left(E \frac{M}{Z_o} \pm MI \right) =$$

$$jwM \left(\frac{E}{Z_o} \pm I \right)$$

Another relationship must be established before again substituting in the rf output voltage equation for e_O. It is important to note capital letter E is used to designate the line voltage.

The voltage E at *any* point on a transmission line is the sum of the forward and reflected voltages, or

$$E = e_f + e_r$$

It should be remembered that e_r during the next few equations represents the reflected voltage; it should not be confused with e_r, the voltage across resistor R.

Then,

$$I = \frac{e_f}{Z_o} - \frac{e_r}{Z_o}$$

The minus sign is because the reflected wave travels in the opposite direction.

$$I = I_f + I_r$$

where

$$I_r = - \frac{e_r}{Z_o}$$

There are two cases to consider: (a) when the resistor is toward the load; and (b) when the resistor is toward the source. So, substituting for E and I in the e_O equation for each case,

$$e_o =$$

$$jwM \left(\frac{e_f + e_r}{Z_o} + \frac{e_f - e_r}{Z_o} \right) =$$

$$\frac{jwM}{Z_o} (2e_f)$$

$$e_o =$$

$$jwM \left(\frac{e_f + e_r}{Z_o} - \frac{e_f - e_r}{Z_o} \right) =$$

$$\frac{jwM}{Z_o} (2e_r)$$

The equations show that the rf voltage from the loop before rectification is directional and proportional to the voltage in the transmission line (due to the forward and reflected wave respectively). Fig. 2 shows that even though E_S is zero, E_r and E_f are still present.

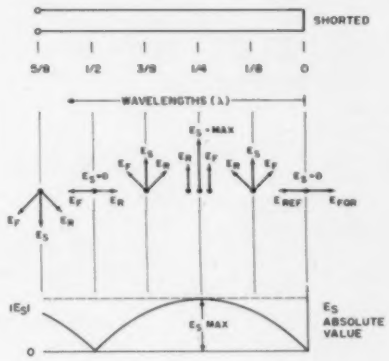


Fig. 2. Diagram of voltage standing waves on transmission line.

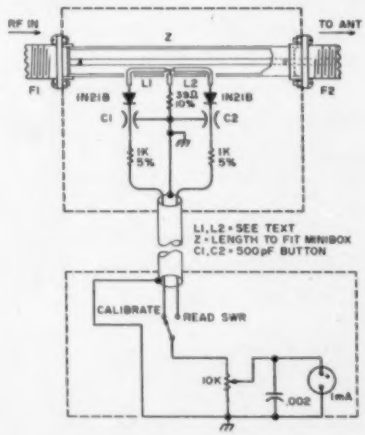


Fig. 3. UHF swr indicator.

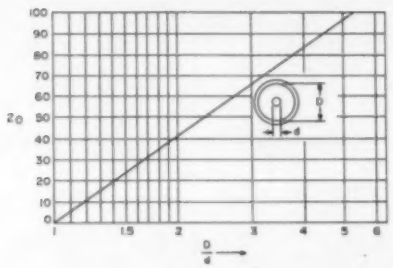


Fig. 4. Ratio of diameters to line impedance.

The frequency limits of the indicator are exceeded when resistor R is not very much lower than distributive element C, and when mutual inductance M is not nearly purely reactive.

Construction Details

A length of copper water pipe is used for the wave sampling section of the transmission line. The use of tubing helps to maintain a constant line impedance, keep the inner field distortion to a minimum, and radiation leakage down. For the center conductor, a #7 or a #3 AWG copper wire will provide a line impedance of 75 or 50 Ohms, respectively. Thin wall model builder's brass tubing of equivalent o.d. was used in constructing the indicator in the article. See Figs. 3 and 4.

To accommodate the sampling loop, drill three 1/8 inch diameter holes ¾ of an inch apart in the copper tubing. Form the insulated sampling loop, and insert the leads through the three holes. Single conductor, tinned, #22 AWG, with thin wall insulated sleeving added, maintains its shape better than stranded wire for the sampling loop. With 3/8 of an inch lead protruding out of each hole, temporarily bend each load so as to make the loop captive. This will help prevent the loop from slipping out of position during the fastening of the end fittings.

Solder the end of the conductor selected for the center lead to a mica-filled SO-239 coaxial fitting. Other types of fittings such as the N or the BNC may be used, but different mechanical arrangements will be required.

The other SO-239 fitting requires modification if no other holes are to be drilled in the outer copper tubing. The modification consists of removing the center pin of the connector. Depending upon the brand and vintage of the connector, some pins are removable by a simple "C" ring clip. Others have a rolled-in ridge for fastening, etc. After the pin has been removed intact, use a drill to establish clearance so that the pin can be freely inserted from the rear side of the connector.

Temporarily slide the copper tubing and loop subassembly over the center conductor with the fitting previously connected to one end. Determine through inspection the proper length the center conductor should be to permit the recently removed center pin to slide into the fitting with the slightly enlarged hole without protruding. The fitting must also butt against the end of the outer copper line. After the proper length has been determined, solder the pin to the center conductor.

Make two rings about 3/8 of an inch long by cutting the ends off a standard copper elbow or coupler section. With all burrs removed, the rings, line, and end fittings are ready for soldering. A 250 Watt gun or iron will speed the assembly.

If the assembly is to fit inside a ready-made minibox, the box selected and the length of the line should be compatible. The box will help keep the sampling loop from being disturbed once positioned. A ¾ inch hole in each end of the box is required, with one hole slightly elongated, so that when the box ends are sprung back slightly, the line assembly may be inserted. The assembly of the rest of the components is straightforward.

To adjust the loops, the line should be inserted into a transmission line, first in one direction and then the other, until the two sets of readings are almost identical (except reversed). Once obtained, place a drop of quick-drying model cement at each of the sampling loop exit leads, without disturbing their placement. Fig. 5 is a typical meter scale.

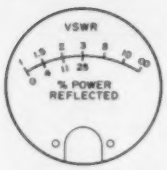


Fig. 5. Typical vswr meter scale.

If the 1N21Bs and resistors have been matched even with the humble ohmmeter, and the parts layout is reasonably symmetrical, little effort should be required to position the pickup loops.

The line and meter may be mounted together in a larger single box if desired. It may also be desirable to use a set of connectors in the interconnecting cable to insert an extension cable when needed to provide remote readings during backyard antenna matching sessions.

The directivity of this indicator, and its ability to discriminate between forward and reflected wave components from 50 MHz to 500 MHz (and maybe even higher), is excellent. The use of type N fittings is recommended for frequencies above 500 megahertz. ■

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**40-10 HD	40/20/15/10	59.50	36/1.01	36/10.9
80-40 HD	80/40 + 15	57.50	41/1.15	69/21.0
75-40 HD	75/40	55.00	40/1.12	66/20.1
75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
75-10 HD (SP)	75/40/20/15/10	74.50	48/1.34	66/20.1
**80-10 HD	80/40/20/15/10	76.50	60/1.40	69/21.0

NOTES
1. Models prefaced '**' will be available 1/77.
2. All models above are furnished with crimp/solder lugs.
3. All models can be furnished with a SO-239 female coaxial connector at additional cost. The SO-239 mates with the standard PL-259 male coaxial cable connector. To order this factory installed option, add the letter 'A' after the model number. Example: 40-20 HD/A.
4. 75 meter models are factory tuned to resonate at 3950 kHz. (SP) models are factory tuned to resonate at 3800 kHz. 80 meter models are factory tuned to resonate at 3650 kHz. See VSWR curves for other resonance data.

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M11

Raymond Barnum WA4MFT
Homer GA 30547

At Last!

A 10m Band Plan

- - requires a CB radio

Here is a plan to use CB rigs on 10 for a worthwhile purpose. If a large number of amateurs go for the idea and equip themselves with a converted CB rig, the result could be a real feather in the ham's cap.

My plan calls for the conversion of the so-called "synthesized" 23 channel rigs to operate with 23 channels on 10. These channels would have uses designated for them as depicted in the accompanying chart. Rag chewing, DX, and routine net operation would be possible with this system, but the real value of it would be seen in a communications emergency.

Where the Citizens Band could be expected to be almost useless in a real emergency due to the immense numbers of undisciplined operators that inhabit its channels, the training and discipline of hams could be expected to yield a very effective local communications system. Because of the fairly low expense involved (compared, say, to 23 channels of coverage on the six or two meter bands), there should be quite a few hams who would provide themselves with the capability to participate in the system.

The rigs themselves are almost ideal for this use; they are small, light, all solid state, and made to operate on 12 to 14 V dc. Most have noise limiter circuits and are very adequate receivers. Conversion for the plan presented here can be accomplished in one evening for around thirty dollars (the cost of six new crystals). To make the conversion, one needs a schematic (usually supplied with the rig), a soldering iron for small work, and the ability to identify and work with basic electronic components. Most hams are so equipped.

The conversion involves changing 6 crystals in the rig. These crystals are in the 37 MHz range; each is to be replaced by a crystal whose frequency is exactly 2 MHz higher. The exact frequencies can be found by consulting the schematic or by looking at the original crystals in the rig. The replacements can be ordered from a manufacturer like International Crystal. Once the changes are made, the receiver and transmitting circuits must be peaked for best sensitivity and power out; my Radio Shack Mini 23 required no other changes. My other CB rig (Royal Sound Model 336) has a similar schematic and should give the same result, though I have not tried it. If you have difficulty, contact another ham who has had some successful experience modifying commercial gear. The detailed conversion of a variety of these rigs is beyond the scope of this article.

Channel	Frequency	Proposed Use
1	28.965	Calling & Distress
2	28.975	Emergency Traffic
3	28.985	Emergency Traffic
4	29.005	Net
5	29.015	Net
6	29.025	Net
7	29.035	Local Rag Chew
8	29.055	Local Rag Chew
9	29.065	Local Rag Chew
10	29.075	Local Rag Chew
11	29.085	Local or DX Rag Chew
12	29.105	Local or DX Rag Chew
13	29.115	Local or DX Rag Chew
14	29.125	Local or DX Rag Chew
15	29.135	Local or DX Rag Chew
16	29.155	Local or DX Rag Chew
17	29.165	Local or DX Rag Chew
18	29.175	Local or DX Rag Chew
19	29.185	Local or DX Rag Chew
20	29.205	DX Only, Short Contact
21	29.215	DX Only, Short Contact
22	29.225	DX Only, Short Contact
23	29.255	DX Only, Short Contact

Table 1. Channels 7 through 19 could be pre-empted for emergency net traffic, should the need arise.

The purpose of this article is to propose a way in which converted CB rigs can be used on one of the ham bands that is apparently under-used and in danger of being lost to amateurs. The idea has potential, but is obviously not completely worked out. If you have objections to this proposal or suggestions on how a better system can be set up, by all means put them on paper and send them to either the editor or myself. Certainly the establishment of such a public service oriented communications system would attract favorable press coverage and the amateur's use of the rf spectrum would be given added justification. ■

Event Timer With Memory

- - double check gravitational laws

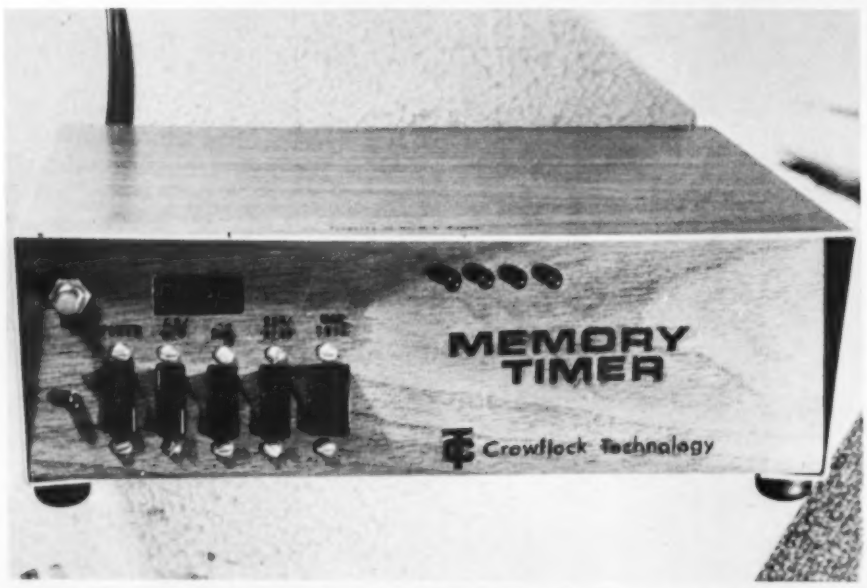
Marshall Jose WA3VPZ
5455 Crowflock Court
Columbia MD 21045

After observing the dubious method used with a crummy timer by my high school's physics teacher to demonstrate the theoretical relationships between distance, speed, acceleration, mass, and time, I decided there must be a better way.

In the true spirit of engineering, I went home and (with time off from homework) worked feverishly on a solution to the above-mentioned farce. "This can be done with digital logic," I grunted, since I am a hopelessly confirmed logic freak. So ... I whipped out my battered TTL data book and started scrawling those funny looking symbols. The next day I discussed it with the physics teacher – and was commissioned with $45 to build it for the school.

Enough about why – what's it supposed to do? Briefly speaking, the device will time several events with 2 digit resolution using either 1 or 1/10 second accuracy. The time elapsed for an event since initial triggering (t = 0) is both instantly displayed and written into the memory.

At present, an operator must trigger the circuit manually when an event occurs; an automatic triggering option is planned to be added soon. After all the events have occurred (up to 16 times may be stored), the times of the events may be read out at the operator's convenience. (Sound like a stopwatch? It is – in a remote sense.) Also, for those who like blinking lights, a free run mode is available which simply counts off seconds or tenths of seconds on the display.



The metalworking for the front panel was done with a drill and with flat and triangle files.

How Does It Work?

By referring to Fig. 1 and Fig. 2, one sees that simply by pressing RESET, the address counter is preset, the counter chain is cleared, and the clock is disabled. Now, if a storage of "event times" is desired, RUN/READ must be at RUN, FREE RUN/MEM must be at MEM – and don't forget to select the range with the S-S/10 switch. After the device is reset, watch what

happens when the MAN TRIG switch is hit: The S-R FF is set, enabling the clock, and the address counter is incremented to 0000 binary. Meanwhile, that delayed one shot, triggered, just sits back for around a microsecond, waiting for the address counter to ripple through. When the address is stable . . . *bam*! goes a 1 microsecond negative going pulse on the write line, the data shoots in the memory and appears on the readouts a little while later!

Subsequent triggering initiates the above nonsense again, with the exception that the clock is not enabled, simply because it already *was* in the initial triggering, and since then has been toggling away at the decade counter chain.

To read, the reset switch is pressed, and the READ/RUN switch is set to RUN, opening the write line. The times are then read out sequentially from the memory on the display.

In the FREE RUN mode, the write line is disabled again, but this time the memory $\overline{WR}$ pins see the gated clock. In this fashion, the memory is used as an exotic "latch," updating the output of the last two decade counters to the displays one thousand times a second. The address on the memory in this mode is irrelevant.

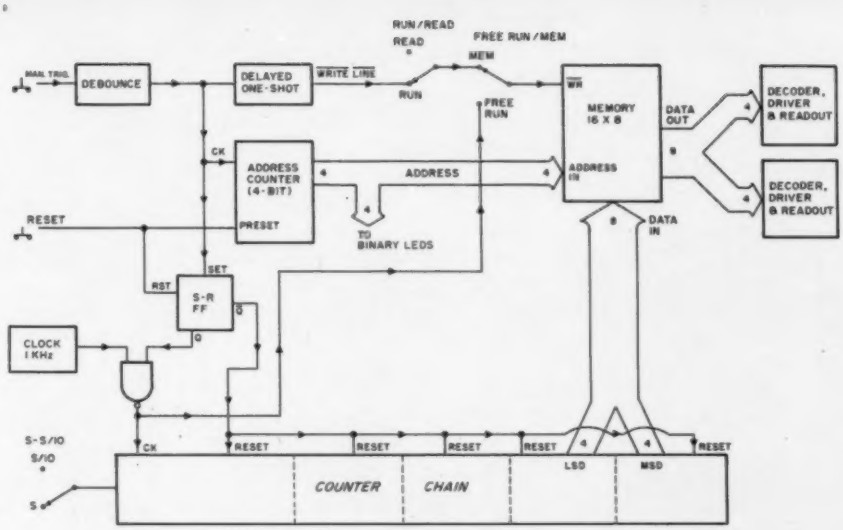


Fig. 1.

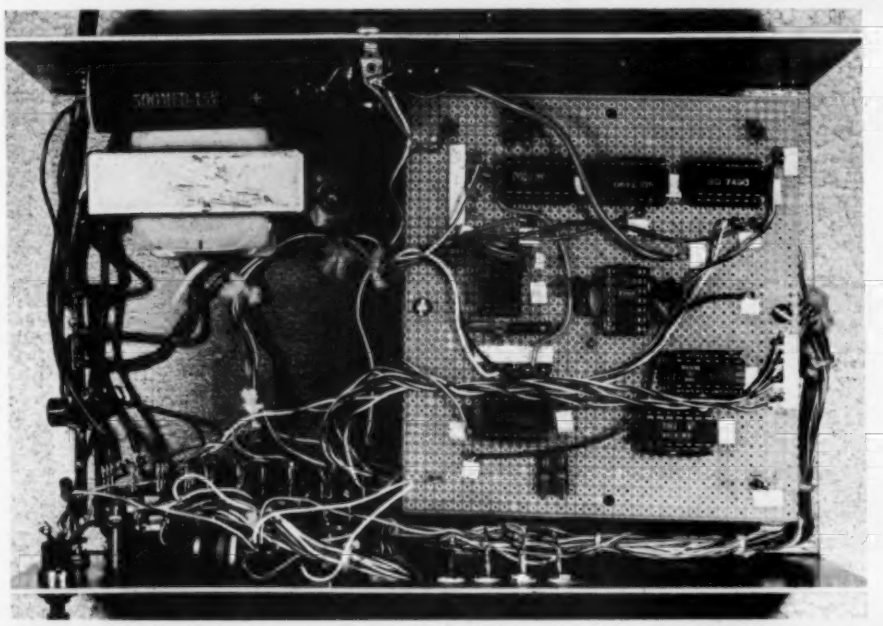
Construction

The acquisition of components for this project was quite an exercise in penny pinching. Exactly $45 was spent after the parts shopping spree. Note that the parts include the case, transformer, breadboard, ICs, etc. — in other words, everything needed. The spacers used to mount the boards were made from copper tubing — cut, constricted, and tapped for 4-40 screws. The interconnection wire was pulled from an unused multi-conductor cable. Talk about being cheap!

The electronics were constructed on *two* breadboards, a nice master-slave arrangement that minimizes space requirements and (usually) interconnections. The prototype boards were wired literally point to point; that is, wiring was done by soldering the wire directly to the two points concerned — using insulated wire, of course. Upon completion, the undersides of the boards would confuse a rat looking for its nest, but the technique worked anyhow.

Two points that must be stressed are that power and ground buses *must* be heavy gauge wire, and that a .01-.1 microfarad capacitor must be connected with short leads between +5 V and ground every few centimeters along the power bus. The reason is that TTL ICs generally create garbage on their supply lines, and this garbage can confuse ICs further on down the power bus unless effectively bypassed. (A good rule to follow is to assemble the boards and *then* solder the capacitors on, every two ICs or so.) Just another ounce of prevention, folks.

Because the readouts have no limiting resistors and because of other shortcuts, the current demand hovers around 900 mA. The LM309K 5 V regulator runs



Top view. Quite a mess, but judicious use of color-coded wires simplified debugging enormously.

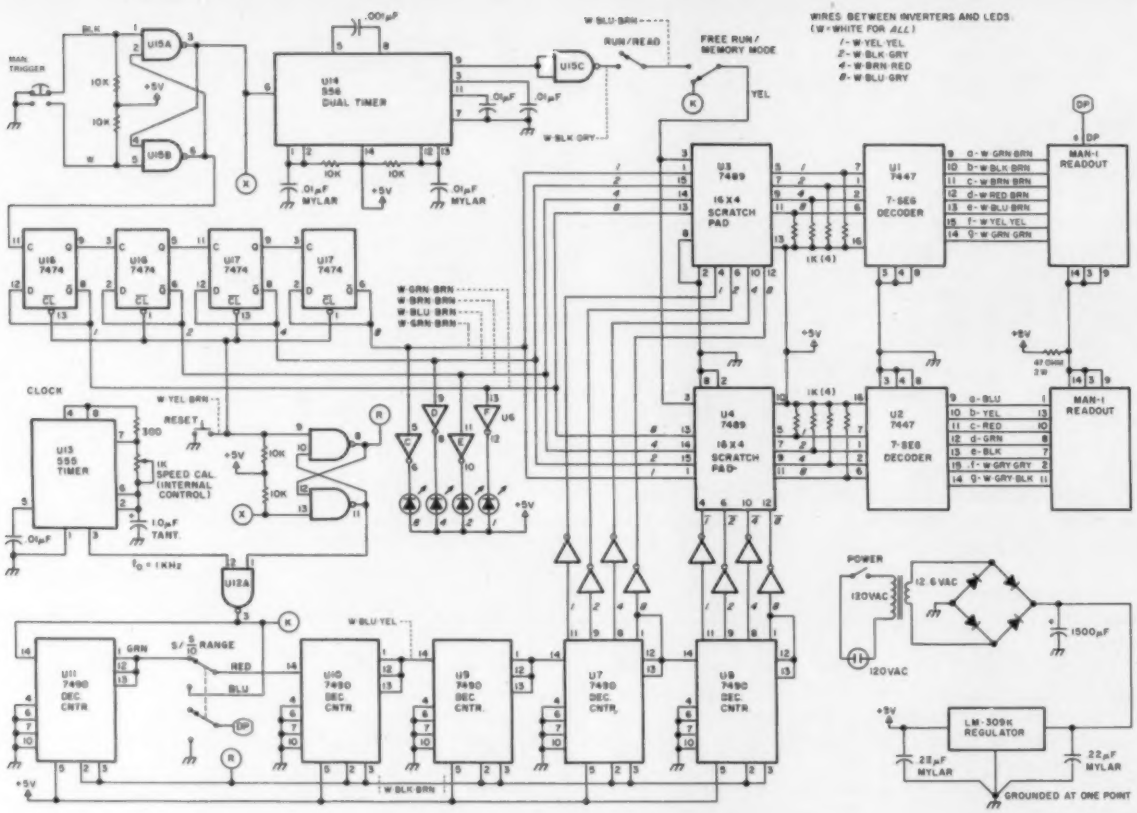
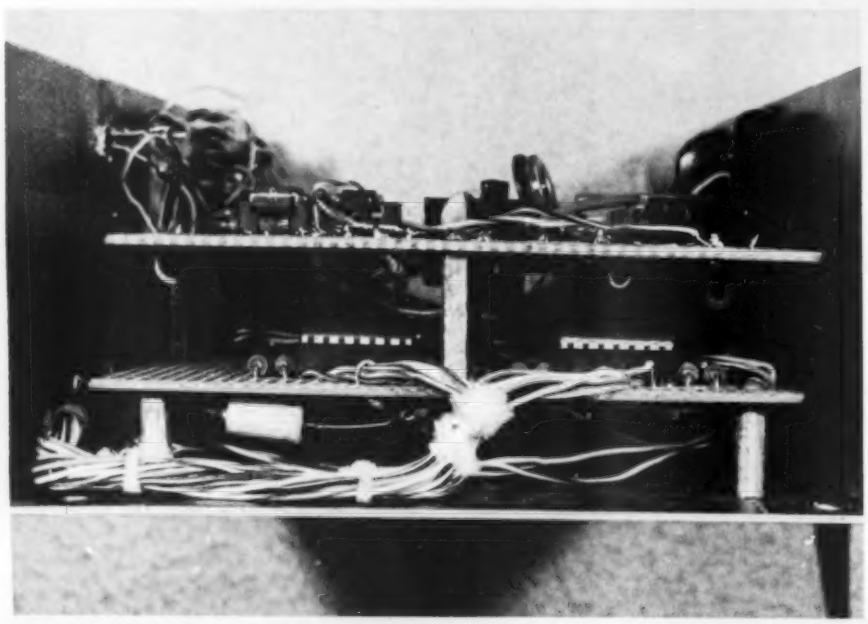


Fig. 2.

moderately hot, not scorching, but still stays in spec. In fact, the regulator is rather hard to destroy, in that it will shut itself down if too hot.

The debugging equipment consisted of a Dumont 304-H oscilloscope, a cheapie VOM, and a homemade logic probe — truly not an expensive troubleshooting lab.

A final remark about construction: The finished appearance will only be as good as how carefully one builds it; the number of tools in the tool box does not necessarily determine the final appearance.



Side view showing stacking of boards and cable ties made of cotton string.

What's It to Me?

It could not be said what one could possibly use the timer for. However, it obviously has applications other than as a peculiar conversation piece. Not only did it win honorable mention and an SR-11 calculator in the Baltimore Science Fair, but also building it and learning from my mistakes while debugging it was half the fun.

If you build it, I encourage you to add embellishments and change it if you like. Since the circuit itself reflects many features of TTL technology, you'll learn from it. Make it a creative project. ■

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H3

Sheet Metal Brake

-- build microwave components

Howard A. Bowman W6QIR
5872 West 77th Place
Los Angeles CA 90045

The ham who builds his own equipment often winds up with one final problem: What kind of a box do I put it in? Small cabinets are not always easy to find, especially when one considers problems of size and appropriate configuration, and the difficulties of "shoe-horning."

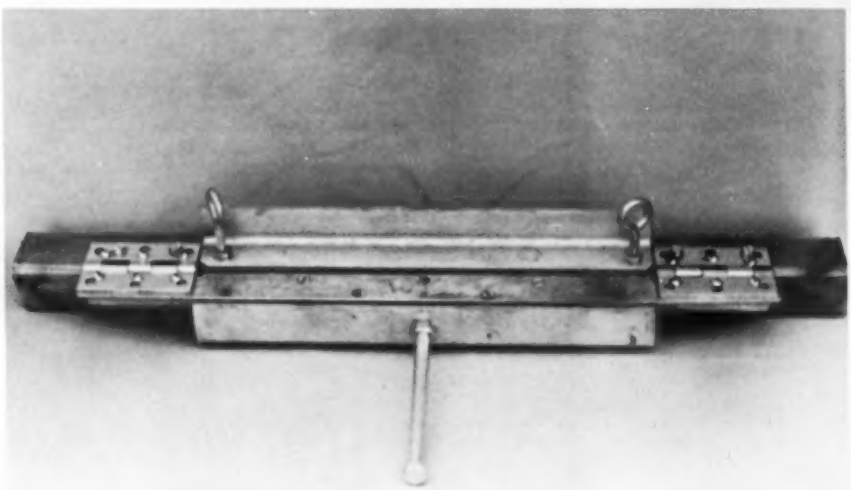
The answer is to make one's own cabinets, each custom designed to fit the project it will house. The device to be described in this article won't do everything that the brake in a sheet metal shop will do, but it will suffice for most tasks.

Ours cost less than $10.00 to build, will handle a 10½" bend, and works quite well on the stock normally used for electronics enclosures. It bends aluminum, whether "soft" or "hard," galvanized iron stock, copper, and so forth. It was built with ordinary tools – nothing more exotic than an electric hand drill and 8-32 and ¼-20 taps. We advise the use of a drill press, if you have one, but it is not imperative; further, you can do without the taps if you don't have them.

We built our brake out of 5 feet of 1¼" angle iron, obtained from a local hardware store, a pair of 3" butt hinges, two dozen 8-32 x 3/8" machine screws (half flat head and half round head), a 3/8" x 6" machine bolt, with two nuts and a lock washer to fit, and two ¼-20 x 2½" eye bolts, with nuts. If you do not choose to tap the 8-32 holes, you'll also need lock washers and nuts for the 8-32 machine screws.

Now, before you run down to the hardware store and buy all this stuff, read through the rest of the article. Further along, we'll suggest a couple of possible modifications which, if you can arrange them, may simplify things considerably. Also, they'll mean your purchases will be a bit different.

Let's take a moment now to identify the major parts of our sheet metal brake. We're frank to say that we could find no reference which would tell us the real technical names of these parts, so we made some up and believe they will suffice.



First, there is the *bed*, on which one places the piece of sheet metal to be bent. The work piece is firmly clamped to the bed by means of the *shoe*, which holds the work accurately in place, and provides a radius against which the bend is made. The actual bending is accomplished by means of the *bar*, which is hinged to the bed. To the bar must be attached a device of some kind to provide the leverage necessary to make the bend. That's where our 6" bolt comes in. And, by the way, when you do get to the hardware store, pick up a couple of extra hacksaw blades. You'll need them!

Let's go on the assumption that you are building the brake out of 1¼" angle iron, as we did, and to the same dimensions. And, by the way, it doesn't have to be 1¼" angle; it could be some other size, but probably shouldn't be less than 1". Use what you can conveniently get. In any case, you'll need a piece five feet long. Select it carefully, looking especially at the ends, which often get deformed when a longer piece is cut up. You'll want a piece that is entirely straight and true. When you get it home, cut it into four pieces. Two pieces should be exactly 18" long, one exactly 12" long, and the fourth what's left over – a bit less than 12", because of the saw cuts.

Put the two 18" pieces on a flat surface, back to back, so that they form an inverted "T". Temporarily clamp them together with a couple of small "C" clamps, then turn over the whole assembly and put it in a vise, clamping it securely at the center. Viewed from one end, the two pieces will now form a "T", and the upper surface of the "T" should be absolutely

flat across both pieces of angle.

Now, take a good look at one of the hinges you have bought. Probably each leaf of the hinge will have three countersunk holes in it. However, you're not going to use the hinges as the manufacturer intended. If you did, the hinge pin would not be axial with the juncture between the bed and the bar. To attain this axial condition, simply flop the hinge over, and thereafter ignore the holes made in it by the manufacturer.

One hinge is going to be mounted at each end of the two 18" pieces of angle you are working with. Further, the axis of each hinge pin must be in exact line with the juncture between the two pieces of angle. Line up each hinge carefully, and mark the pieces of angle for cuts which will clear the hinge pin and surrounding metal on each hinge. These cuts, made with a hacksaw, don't have to be super accurate, but they must remove enough metal from the vertex of each piece of angle to allow the center portion of the hinge to drop in, leaving each leaf of the hinge flat against its respective piece of angle (see Fig. 1). In our case, we had to remove about ¼" from the vertex of each piece of angle to a depth of about 3-1/8" from each end.

Once this hacksawing is finished, so is most of the hard labor. Realign the two pieces of angle as before, and put them back in the vise. Put each hinge in its position and, as before, carefully align its pin with the juncture line between bed and bar. Remember also that each hinge goes on upside down,

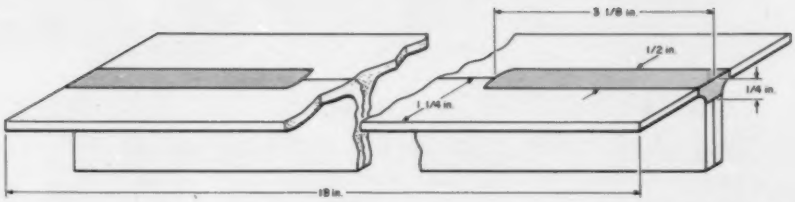


Fig. 1. Enough metal is cut out (shaded areas) to allow room for the hinge pins and surrounding metal.

with its countersunk holes toward the pieces of angle. Moreover, each hinge should now lie flat, with the hinge pin and surrounding metal in the slot you have just hacksawed out.

Securely clamp each hinge in place and center punch on each leaf of each hinge three locations for your 8-32 round head mounting screws. These locations should be relatively close to the hinge pins, yet far enough away to clear the screw heads, and the nuts, if you intend to use them. While the hinges are still clamped, drill out the three holes with a No. 29 drill, which will accept an 8-32 tap. When all holes are drilled, remove the hinges and redrill the holes in the hinges only with a No. 18 drill, which will clear the 8-32 machine screws. If you're going to use lock washers and nuts, you can drill with the No. 18 to begin with. If you are using the drill-and-tap method, with the hinges off, you can now tap the holes in the bed and in the bar, and then remount the hinges. Fig. 3 shows how the hinges mount.

Next job is to mount the shoe. It is positioned atop the bed, as shown in Figs. 2 and 3, and is a 12" piece of angle. Carefully align one edge of the shoe with the juncture of the bed and bar, and clamp it in place. Then, about ½" in from each end, drill through both the shoe and the bed with a No. 7 drill, which will accept a ¼-20 tap. Remove the shoe and redrill the two holes in it to clear the ¼" x 2¼" eyebolts which will be used here as clamps. Use your ¼-20 tap on the two holes in the bed. Run a nut about ½" on each eyebolt before installing it, and you will find that the combination will clamp the shoe firmly to the bed.

Again, if you are not going to tap the holes in the bed, you will find it necessary to devise an alternate method of clamping. Later on you will see that we attached the brake to a piece of 2" x 2" lumber to afford a means of holding the brake in a vise or clamping it to the workbench. From this, one method of providing a clamp for the shoe that suggests itself would be to run long quarter-inch bolts through the wood mount, with nuts between the mount and the brake bed, but with the bolts extending through both bed and shoe. Then wing nuts might be used for clamping.

The final task is to provide some leverage for making the actual bend in a piece of sheet metal. We accomplished this by mounting the last piece of angle – the one slightly less than 12" long – to the bar. It was clamped to the bar and seven No. 29 holes were drilled in a staggered fashion across the length of the angle. The clamps were removed and the holes in this last piece were tapped with an 8-32 tap. Holes in the bar were then redrilled to pass the 8032 machine screws, and countersunk so that the flat head screws would be flush with the surface of the bar.

If any screw heads are slightly cocked, they should be filed flush. If problems still remain, all is not lost. When a piece of metal is to be bent, a thin sheet of paper or plastic slipped between the work piece and the surface of the bar will protect it.

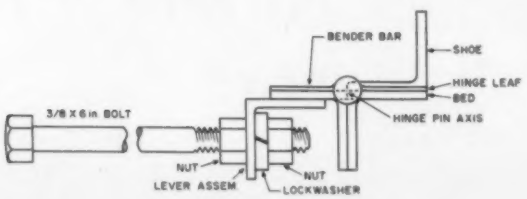


Fig. 2. End view of principal assembly.

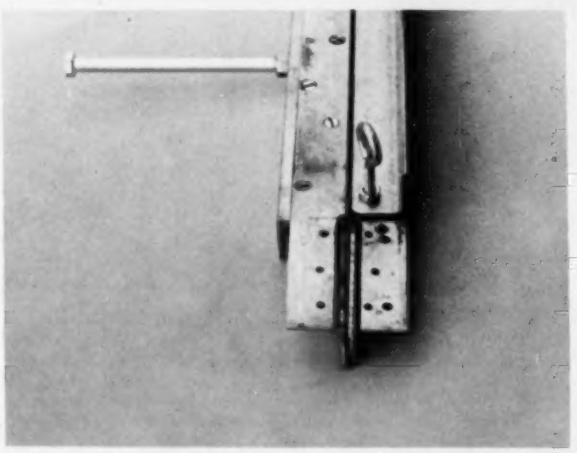


Photo shows how ends of pieces of angle iron are hacksawed out to provide mounting for hinges.

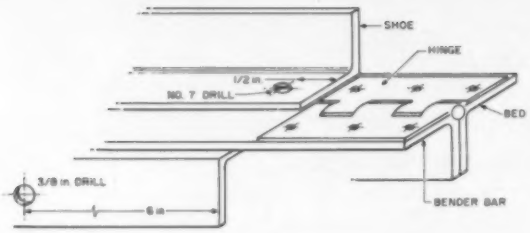


Fig. 3. Hinge positioning and location of bending lever.

Here again, if the builder does not wish to tap the holes for the 8-32 mounting screws, he may drill the holes to clear them and use lock washers and nuts on the under side. If this is done, precaution should be taken to drill the holes in positions so that there is room for the nuts on the underside of the angle.

The final step is to add the 3/8" x 6" machine bolt to the outer face of the piece of angle we have just attached to the bar. Simply find the center of the outer face of that piece of angle, and drill a 3/8" hole through it. Run a nut on the machine bolt about ½", put the end of the bolt through the 3/8" hole, and secure it on the inside with a lock washer and nut.

It is at this point that a couple of attractive alternatives suggest themselves. Note that when this last piece of angle has been attached to the bar, these two pieces form an inverted "U", as shown in Fig. 2. Since the means of attachment is unimportant, so long as it is sturdy, the two might be welded together, if you have access to welding equipment. Note, however, that if any portion of the welding bead extends above the face of the bar, it will have to be ground or filed off, to prevent marring the work.

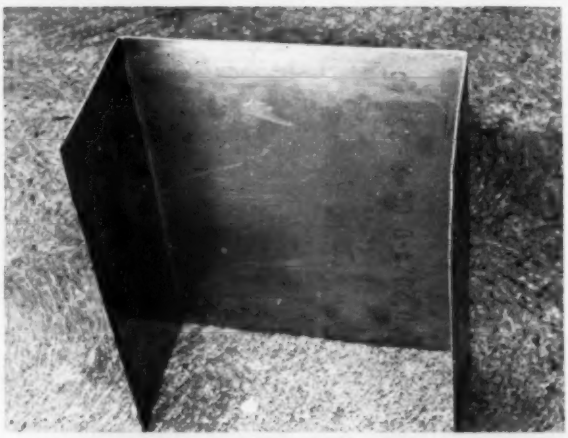


Photo shows half of a cabinet produced with the brake described.

Even more attractive is the idea of substituting a piece of channel for the bar, and perhaps even for the bed. This would obviate the use of screws, welding, or any other means of attachment.

As indicated earlier, some means must be devised to hold the brake securely while it is in use. We simply used wood screws to attach the bed to a piece of 2" x 2" lumber about two feet long. When not in use, the brake may be stored in an obscure corner. To use it, we simply clamp the 2" x 2" to the bench with a pair of large "C" clamps, or hold it in a vise. ■

Pete Walton VE3FEZ
421 Lodor Street
Ancaster, Ontario L9G 2Z9

The Easy Ammeter

- - current news

Have you ever wanted to measure the current flow of a particular transistorized device that is sitting on your workbench?

If you are like most of us, you are basically lazy and sometimes bypass this important step, due to the inconvenience of breaking the power lead and then having to resolder it again.

Here's a really easy way to measure current flow. Since most transistorized gear is powered from a battery pack of some sort, all you have to do is stick a piece of double-sided printed circuit board between any two batteries, as shown in the diagram.

Touch the two meter leads to each side of the PC board and there you have it — instant current reading without cutting and soldering any wires. ■

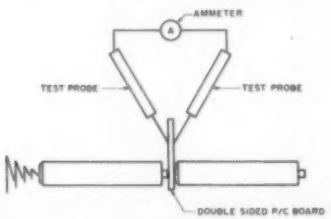


Fig. 1.

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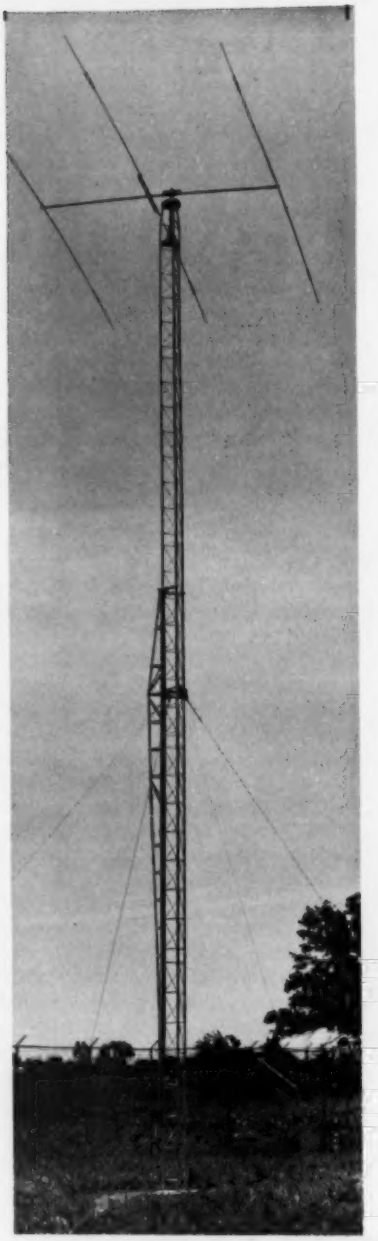


William L. Reeve WB9DVV
335 North Elmwood Lane
Palatine IL 60067

Try a Conduit Vertical

- - low angles are great for DX

Ever since my Novice days, not all that many years ago, I've been spending most of my time on the air in search of that increasingly elusive critter known as "DX". However, with the serious decline in the sunspot cycle and sometimes total lack of DX on the air during this past year, I found I was spending more time in good old-fashioned rag chews. As a result of working some states on bands I'd never worked them on before, I became interested in trying to achieve 5 Band Worked All States.

The first problem I had was in getting back on the 80 meter band. After upgrading from Novice, I had sold off my 18 AVQ allband vertical in favor of a beam with which I set out to chase DX. Having nothing really suitable enough from which to string a good dipole antenna, I decided on a ground mounted vertical. Now, the handbooks are replete with vertical antenna designs, but few ever suggest means for building an unguyed, free-standing configuration by using easily obtainable materials. I recalled that when I had first gotten on the air as a Novice, I built myself a home brew rotatable dipole for 15 meters. You may recall this old *ARRL Handbook* design, which utilizes two ten foot lengths of 1/2 inch thin wall electrical conduit mounted on a short length of 2" x 2" redwood with standoff insulators. I felt this same type of construction should work in home brewing a vertical.

I found that thin wall electrical conduit of 1", 3/4", and 1/2" would telescope into one another, but not with a sliding fit. By cutting a couple of two inch lengths off the ends of the 3/4" section and slitting them lengthwise, I was able to expand these small sections to fit around the end of the remaining length of 3/4" conduit as shims, spaced about 8" from one another (see Fig. 1). This shimmed end, with the help of a little electrically conductive lubricant, was easily forced into one end of the 1" conduit.

To insure electrical continuity and to prevent slipping of the two sections, I drilled radial holes through the two joined sections at the shim locations and inserted heavy pan head sheet metal screws.

The same procedure was followed in telescoping the 1/2" conduit into the other end of the 3/4" conduit. To prevent corrosion at the joints, it is suggested that they be sealed at their ends with a bead of automotive grommet sealant or vinyl electrical tape.

When the three lengths of conduit were fastened together, I prepared a vertical support using a 4 foot length of 2" x 4" redwood. Four 2" standoff insulators were mounted on the redwood support, and equally spaced from one another, beginning at approximately one foot from one end. A fifth standoff insulator, which may be of smaller size, is attached at the free end. The one inch conduit section is then fastened to the ends of the four insulators using loops of 3/4" perforated metal stripping which is available in most hardware stores (see Fig. 2). To prevent the conduit from sliding down through the loops when the finished antenna is elevated, pan head screws are inserted through holes in the loops and fastened to the bottom conduit section.

Since the finished length of the three telescoped sections of conduit is approximately 27 feet 4 inches, it will be necessary to add an adjustable base loading coil to enable the finished antenna to resonate properly at various frequencies. One end of this coil should be fastened to the bottom end of the one inch conduit section, and the other end is fastened to the unused standoff insulator (see Fig. 3). An SO-239 coax fitting should be mounted on the lower end of the redwood support, near the end of the loading coil fastened to the standoff insulator, by means

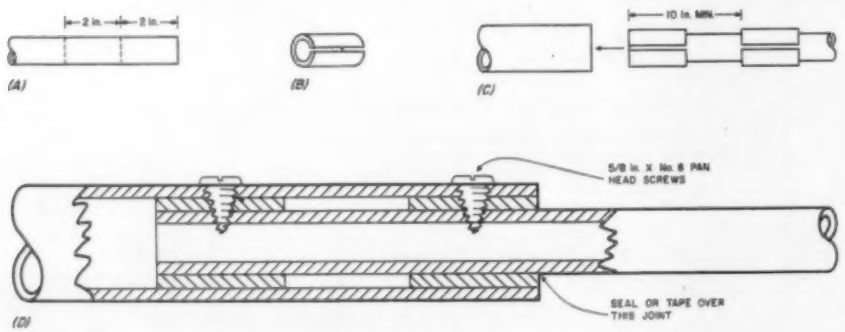


Fig. 1.

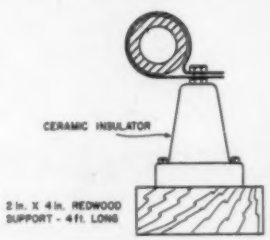


Fig. 2.

of a right angle metal bracket. A short length of wire, to serve as a coil tap, is run from the center conductor of the SO-239 coax fitting to the desired resonance spot on the loading coil, and soldered at each end. The tap location on the loading coil is a fit-and-try operation after the antenna is erected and placed on the air, the object being to find the tap location which gives the lowest swr at the desired operating frequency.

If you intend to use the antenna for more than one operating frequency, you will need to have a small clamp connection on the tap wire which will allow you to move its location on the loading coil. If your station includes a transmatch or similar matching device, you may eliminate the loading coil and simply run your tap wire directly from the coax fitting to the lower end of the one inch conduit. Loading of the antenna is accomplished by simply tuning the transmatch for lowest swr.

Having completed assembly of the antenna and its support, it is a simple matter to fasten the redwood support with U-bolts to a pipe of at least 1-1/2" diameter driven into the ground a minimum of 4 feet. Get some help in elevating the antenna and mounting it on the pipe, however, because it is not a lightweight antenna, and you will very likely break the ceramic standoff insulators if it falls to the ground.

As with any vertical antenna, a network of radials should be securely connected to the ground side of the SO-239 coax fitting at the base of the antenna. A few eight foot ground rods, also connected to this ground side of the coax fitting, should be driven into the ground equally spaced from one another on a 12" radius from the support pipe.

This antenna has been in operation at our home QTH for nearly a year and has stood up well to windstorms with no damage. We have managed to obtain many of the QSLs needed for 5 BWAS on 40 and 80 meters using this antenna, and it has also operated well on 40 and 80 meter DX in the most recent CQ WWDX contest. It has also performed admirably in acquiring those states needed for the Bicentennial Worked All States Award.

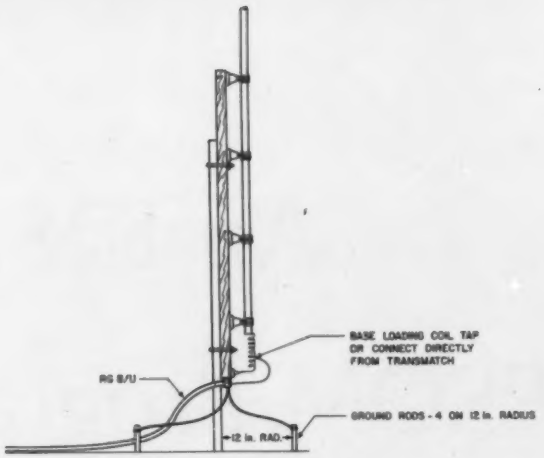


Fig. 3.

If you want a good antenna for 80 and 40 (and other bands for that matter), the electrical conduit vertical is a cheap and effective way to go, especially if you don't have the room, or inclination, to string up one or more dipoles. ■

Craig Corsetto WA6OAA
233 Florence Dr.
Aptos CA 95003

The IC-PC Connection

-- convenient and cheap

Having become enveloped in the digital mania, and breadboarding many circuits, I came across a problem that I'm sure many have stumbled across. As the projects became more complex, I found the wires coming off the perfboard it was constructed on more numerous. This becomes a big headache when modifying the circuit and having to unsolder, then resolder, all those darn wires. A cheap, but easy, connector was the only way. Not wanting to spend all my time hunting around for the right type of connectors, I decided to gamble and sent off for some ordinary "Soldertail Standard" IC sockets hoping they would be easy to modify. Luckily they worked out quite well, and I'm surprised no one has thought of it before. Since from 8 to 24 pin (and greater) IC sockets are easy to latch on to, the quantity of wires coming off the board presents no problem. Here's how it's done.

First, that socket pops apart by snapping off the cap or top section, leaving you the base or bottom section. Those things you're picking off the floor are the pins. The pin holes in the cap need to be drilled out wide enough to accommodate the width of the wire, and the pins have to have the formed spring contacts bent apart so the wire can slip down between them. The pins are a little difficult to work with, so be patient, and whatever you do don't do this over a shag rug because the only way to find a lost pin is the hard way, barefoot and unexpected.

To put it together, just thread the wire(s) through the cap, strip off 1/16" of insulation and solder to the pin. Once all the other pins are completed, slide the pins back into the base and slide the cap down until it snaps in place. Fini! When using ribbon cable, the end product looks good enough to use these connectors on the finished project when laid out on etched circuit board. Since "Soldertail Standard" sockets when used as the male connector won't plug into a "Low Profile" socket, you will have to use the "Soldertail Standard" for both male and female. ■

R. M. Stevenson WB2CZL
18 Compass Court
Huntington NY 11743

An 82S23 PROM Programmer!

-- now build those projects using one!

The 82S23 is merely the Schottky version of the 8223 programmable read only memory which has become popular in home-built amateur radio equipment. A year ago the 8223 was plentiful on the surplus market. Now, however, the supply is drying up because it is no longer manufactured (at least not by Signetics Corporation). Being an experimenter, I bought the Schottky type PROMs when they were offered at the same price as the 8223. I was in trouble immediately. My programmer was the usual simple type the circuit of which has been published in several hobby magazines. Even by using a fusing potential of 15 volts and no current limiting, I could not blow the links.

A Solution

A chance acquisition of the publication, *Signetics Bipolar Memories* (current issue, no date), led to a solution to my problem. Among other things, the manual shows a circuit for programming the 82S23 and the 82S123 (3-state output). Evidently a short rise time and a controlled amount of fusing current are required to completely and permanently fuse the links in a Schottky PROM. Five 1-shots are used to automatically pulse three parameters of the PROM. A hurry-up version of the circuit was put together and it works just fine. No construction details are included in the manual, so a potential builder might benefit from my labors.

The Schottky programmer is complicated and costly when compared with the simpler programmer usually used for home programming of the 8223 (e.g., *RTTY Journal*, February, 1976, page 9). Also, the programmer will not be used often, so the average ham will look to avoid buying parts. Be sure to check all switches to be used in the address and bit positions. Old toggle switches sometimes hang up and toggle later. This could ruin a PROM. I lost one that way even though I had checked and doubled-checked the switch.

Remember that there are two configurations for double-throw toggle switches (something that even the catalogs don't always mention). Some switches have the "ON" position coincident with the toggle handle, and in others the handle is opposite the "ON" position. Wiring will be made more difficult, but be sure to install the switches so the positions of the toggle handles mean the same thing. A quad NAND gate and two 2N697 transistors may be used instead of the dual peripheral driver. A resistor of about 470 Ohms should be placed between the outputs of the gates and the transistor bases. Be careful in using a lower value of dropping resistor to get more brilliance if you substitute LEDs; the DUT (device under test) may have to sink too much current. An SE 9300 family transistor may be substituted for the MJE 1103 (it must be a Darlington type). Be sure to provide heat sinking for all three voltage regulators. The zener diode clamp at VR3 will overheat and fail if pin 3 of the regulator is left ungrounded for an extended period. An additional 1-shot and LED may be used to see if the 1-shots in the circuit are functioning. See page 84 of *Radio Electronics Magazine* for June, 1976.

Referring to page 26 of the Signetics manual, the timing diagram below the circuit diagram indicates the action initiated by the five 1-shots. However, more information is needed to fully explain the operation. See Table 1. CR1-CR3 are the diodes in the base circuit of Q2 (2N2222). Q1 controls the 15 volt input power to VR2. Q3 and Q4 are the substituted 2N697 transistors. Q3 controls output of

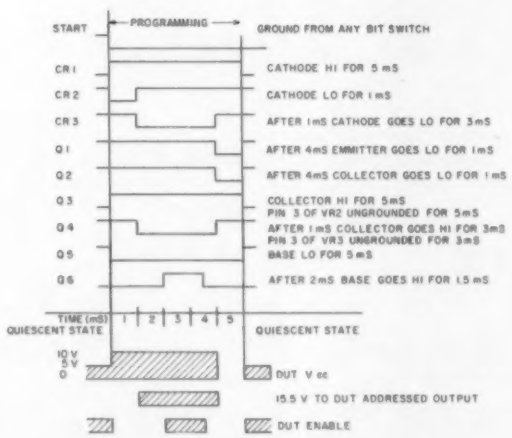
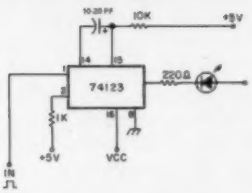


Table 1. Programmer timing diagram.

Fig. 1. Pulse catcher, Radio Electronics Magazine, *June, 1976.*



VR2, 5 volts for DUT verification and 10 volts during most of the programming cycle. VR2 output is forced to zero, however, near the end of the cycle, by action of Q1. Q4 switches output of VR3 from zero to 15.5 volts for fusing the links. Q5 and Q6 are in the NOR gate which enables the DUT. U4 is the substituted quad NAND gate.

With the simpler programmer, an address is selected and about 12.5 volts is applied for (hopefully) ½ second. In the Schottky version of the programmer, fusing operation is as follows:

1. DUT disabled;
2. Vcc raised to 10 volts for 4 ms;
3. After 1 ms (after start of programming), addressed output is raised to 15.5 volts for 3 ms;
4. After 2 ms DUT is enabled for 1.5 ms;
5. Both Vcc and fusing voltages go to zero for 1 ms.

At the end of the 5 ms programming period, conditions revert to their quiescent state (5 volts at Vcc and DUT enabled).

Inasmuch as these memories are irreversibly programmed, the unit should be checked each time it is used (DUT not installed).

U4 (7400) Not In Socket

1. All LEDs lighted.
2. Check 10 volts at DUT socket pin 16.
3. Check logic LO at DUT socket pin 15.
4. Check 15.5 volts at DUT socket pins 1-9 when BIT switches are in the N.O. position and 2 volts when in the N.C. position.

U4 In Socket

1. All LEDs lighted.
2. Check 5 volts at DUT socket pin 16.
3. Check 0 volts at DUT socket pins 1-9 when BIT switches are in the N.O. position and 5 volts in the N.C. position.
4. Logic LO at DUT socket pin 15.
5. Check 5 volts at DUT pins 10-13 when ADDRESS switches are in the "1" position and 0 volts when they are in the "0" position.

It is well to check that the DUT has not already been programmed or has missing bits for some other reason. After checkout of the unit as above, use the following procedure to verify the status of the DUT.

1. Set ADDRESS switches to the "0" position.
2. Set BIT switches to the N.C. position.
3. Insert DUT.
4. Any LEDs that are lighted indicate blown links at address 00000.
5. Check other addresses as appropriate by setting the ADDRESS switches. (Do Not Touch The Bit Switches.)

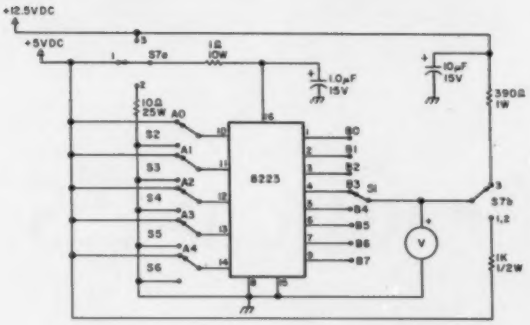


Fig. 2. "Simpler" programmer circuit.

Operation

Programming the DUT is pure simplicity, but attention to detail is enforced just as in any programming.

1. Set ADDRESS switches.
2. Actuate required BIT switch to blow the link.
3. The LED will light.
4. Actuate any remaining switch for logic "1" at that address.
5. Set next address and continue.

Conclusion

This programmer for Schottky PROMs works fine for the non-Schottky 8223. Industrial users of PROMs are not always so lucky with their exotic, automatic programmers. One $8,000 machine will program the 82S23 but not the 8223. There are substitutes for the 8223 and 82S23 but caution is advised; there are subtle differences. For instance, in some units, the outputs are programmed from "1" to "0" instead of from "0" to "1" as in the 8223 and 82S23.

A review of other programmer circuits in the Signetics manual makes it apparent that a "universal" programmer could be built to program at least all of the Signetics PROMs of this type. A universal programmer would make an excellent club project. In addition to automatic identifiers for repeaters and RTTY, the impact of microprocessors is beginning to be felt by almost everyone. As more "software" becomes available, operators will want some of their short routines stored in "firmware." ■

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Practical P.S. Design

- - do it right this time

One of the most common types of articles published is that on the building of a power supply. Usually the power supply will be a 12-14 volt unit which is capable of providing 3 Amps or so, which will power most solid state VHF transceivers. What is apparent from reading these articles is that most hams do not really understand power supply design, and, because of this misunderstanding, will waste parts and end up with a design which is not doing what the builder wants. This article will try to reveal some of the more common pitfalls, and present a simple design which will provide good, safe, general service.

The first part of any power supply to look at is the power transformer, diode rectifier, and filter combination. We want to get a transformer with a rating of greater then 12 volts, since we want a regulated output of 12-14 volts. It would be best to get a transformer of about 15 volts rms rating, but this is not a very common transformer. A transformer of a higher voltage rating (20 volts or so) is OK, but this would mean the regulator would have to dissipate a lot of heat, which wastes power.

About the best we can do is get a transformer which will deliver a solid 12.6 volts at 3 Amps. Some of the less expensive transformers will drop several volts at full current — try to avoid these. You may wonder how to get a regulated 12.6 volts from a 12.6 volt transformer. The trick is in the rating of the transformer in rms voltage. Since ac voltage is constantly changing in value, at any given instant its absolute voltage may be anything from zero to the peak value. Because of this, ac voltage is given based on how much work it will do. 12.6 volts ac rms will do the same work (heating a resistor) as 12.6 volts dc; however, the peak ac voltage is 1.414 times the rms voltage. A simple rule of thumb is, "split rms in two, and add this figure to the rms." This would say, 12 volts divided by 2 equals 6 — add this to 12 for 18 volts peak.

This method gives a ballpark figure which is close enough to work with. Using this figure of 18 volts, I know I want rectifier diodes which have a reverse breakdown rating of greater then 18 volts, and can handle current in excess of 3 Amps. This part is easy, since most power rectifier diodes handle at least 25 volts. In selecting the diodes, it is best to allow a margin of safety to allow for current surges and voltage spikes. The turn-on current surge could damage the diodes when the power supply is first turned on, but the resistance of the transformer's winding is usually enough to protect the diodes (which are able to handle currents on the order of 50 times the diode rating) for a very short period of time. In this case, a 5 Amp, 60 volt bridge would be good.

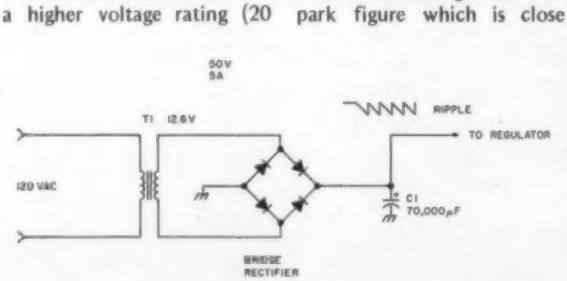

Fig. 1.

Now comes the filter. There are several types of filters, but we will only go into the most common, which is the capacitive input type. This filter is simply a capacitor across the output of the rectifier. This capacitor will, under no load conditions, charge to the peak value of the voltage from the transformer, or, in this example, to about 18 volts. The capacitor must have a voltage rating of at least 18 volts (preferably 20 volts). One of the major pitfalls is encountered in the selection of this capacitor. It does not need to be so large as to give pure dc at full load. Its value should only be large enough to prevent the voltage drop between charging pulses from the rectifier from dropping below the point where the regulator falls out of regulation. Most regulators will require no more then 3 volts across the series pass transistor to maintain regulation. That being the case, we may have 18 V-12 V plus 3 V for 15 volts minimum before dropping out of regulation. Fifteen volts minimum from 18 volts maximum gives a maximum of 3 volts allowable ripple. To have a larger capacitor and less ripple serves no useful purpose and wastes space with the larger capacitor. To figure this capacitor value, figure the regulator impedance as seen from the filter capacitor under full load: 3 Amps (full load), 18 volts (peak charge), divide (E/I equals R) 18 V by 3 A, giving us 6 Ohms.

A simple review reminds us that T equals RC, or resistance (in Ohms) times capacitance (in farads) equals time (in seconds) for a 63% charge or discharge of a capacitor. If we draw the discharge curve of a capacitor and label the top as the peak 18 volts, and the 63% discharge point (6.6 V), we can now see what percentage of the discharge time it takes for the capacitor voltage to drop below 15 volts (regulated output voltage plus 3 volts). In this case I will refer to the *Amateur Handbook*, where there is a printed graph which shows time constant vs. percent of discharge. The 3 V allowable discharge is about 16% of the charge which becomes, on the graph, 84% charge at about .2 time constant. As you can see, a greater peak voltage would allow more ripple to play with, and hence a smaller filter capacitor. In this case it will require 5 (1/.2) time constants to not drop below 84% of charge between charging pulses from the rectifier. The power supply will be running from 60 Hz ac and the full wave rectifier will put out charge pulses at a 120 Hz rate, or one pulse

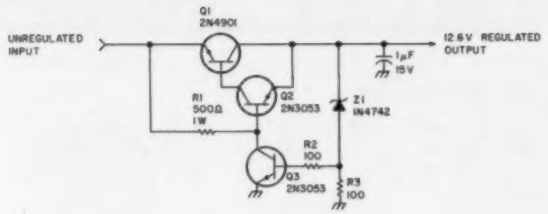

Fig. 2.

every 8-1/3 ms. Five times this figure gives a required time constant of .416 seconds. Now we know that R equals 6 Ohms and T equals .0416 seconds, and that T/R or .0416/6 equals .0069333 farads or 6,933 uF. This says that with the transformer and current requirements given, this power supply needs 7,000 uF for filtering.

After what has just been discussed, to remain pure I must mention that the regulator does not remain a constant 6 Ohms. This is because the regulator adjusts to maintain regulation and as such is more of a constant current sink. This being the case, the discharge curve will be a straight line (linear) until the regulator drops out of regulation. When dealing with the upper part of the discharge curve, as we are, the difference is unimportant, and falls into the area of slop to be covered by the "margin" factor.

Now for the regulator, another pitfall. Nowadays the easiest thing to do is use an IC regulator with a external pass transistor. For the sake of this article, the IC route won't be followed, since we would not learn much about how it works. Refer to Fig. 2 for the regulator we will be using. The series pass transistor will be selected mostly by the current capability. We want a PNP that can pass 3 Amps and dissipate 15 Watts or so. The dissipation required is determined by the voltage drop across the series pass transistor at full load. Since at that point the filter cap will also have maximum ripple giving lower average power, we can add a safety margin by maintaining the full voltage differential for our calculations. 18 V-12.6 V equals 5.4 V. 5.4 V x 3 A equals 16.2 Watts worst case dissipation. A small heat sink and almost any power transistor can handle that. Let me inject that to parallel series pass transistors is a total waste, in this case, as almost any power transistor can handle this power level.

To point out a common mistake, you cannot just parallel two transistors. Refer to Fig. 3(a). It won't work, although it will appear to. The base emitter junction is electrically a diode with a conduction voltage of about .6 volts for a silicon transistor, and about .2 volts for a germanium transistor. It may be assumed that no two junctions are exactly alike, and because of this, one will conduct before the other, not allowing the base voltage to rise further, to the conduction point of the second transistor. Thus it will not turn on unless the first transistor is damaged.

Two transistors can be paralleled if a small resistor is placed in the emitter circuit of each transistor. This allows a small voltage change in the base emitter circuit, with the current through the transistor. If one transistor conducts more than the other, the voltage builds across the junction of the conducting transistor, causing the other transistor to turn on harder, striking a balance. Without this emitter balancing resistor, the second transistor is wasted. Refer to Fig. 3(b).

Now to pick a series pass transistor ... PNP ... 20 Watt ... inexpensive, and some gain. As you can see, almost any PNP power transistor will do, but let's pick a 2N4901. This transistor is rated for 40 V, 85 W, and costs about $1.75 from Motorola. The gain for this device is a minimum of 25, which means that at 3 Amps we must be able to supply a worst case base current of 120 mA. The best way to do this is to use another transistor which will amplify a much smaller current. For the driver transistor, we will pick a 2N3053, which has a breakdown voltage of 40 volts and a minimum gain of 25. Refering to Fig. 2, we will wire Q1 and Q2 together as shown, in a compound Darlington configuration.

Now to figure the value of resistor R1, which must supply enough base drive to provide the worst case drive to Q2. Since Q2 must drive Q1 with a maximum of 120 mA (output current divided by gain of Q1), we will drive that 120 mA by the gain of Q2 to get a rounded off 5 mA drive requirement for Q2. At 3 Amps output, the filter capacitor voltage will be dipping to as low as 15 volts, so with a worst case low input voltage of 15 volts and division by .005 Amps, we find that the resistor value should be about 500 Ohms. To figure the power dissipation of the resistor, we must take the maximum voltage across it, which occurs at no load, with maximum charge on the filter capacitor. We know from earlier that the no load voltage will be about 18 volts. The base of Q2 will always stay within about 1/2 volt of the output voltage, so we now know that the worst case voltage across R1 will be about 6 volts. Again, using Ohm's Law, we take the 500 Ohms and divide into the 6 volts to our current at 120 mA. I times E equals P, or .12 Amp times 6 volts equals .72 Watts. A one Watt resistor would be in order here.

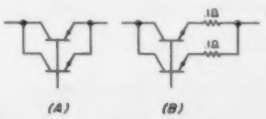

Fig. 3.

Now for the feedback loop which makes this into a regulator. Z1 is a 1N4742, 1 Watt, 12 volt zener diode. It is connected as shown with R3, whose only purpose is to sink any leakage the diode might have and to assure that the diode operates in its proper current range. The value is not critical and the 100 Ohms shown will allow about 6 mA to flow through the diode before regulation takes place. The purpose of R2 is only to protect Q3 against a sudden current surge that might damage the base junction before the regulator can respond. With Q3 installed as shown (almost any NPN transistor will work), any current in excess of the 6 mA designed to flow through Z1 will turn on Q3, causing it to steal base current from Q2 until the output voltage reaches the cutoff point of Z1. The circuit won't allow the output to go above 12.6 volts (the extra .6 volts comes from the base junction of Q3), and if it tries to go below 12.6 volts, Q1 and Q2 drive harder and won't allow that. So what we have is a rock solid 12.6 volts.

Now for the final pitfall. C2 is not a filter capacitor. To try and filter at this point will waste a big capacitor. C2 should only be a small capacitor to *bypass* any high frequency noise which might appear at this point. A 1 uF will do just fine.

In conclusion, while this article was intended to show how to design a simple power supply and avoid some of the common pitfalls, if built it will provide a solid, pure 12.6 volts at a continuous 3 Amps. In fact, since all was figured on worst cases, it will supply in excess of 3 Amps and not feel much strain. Current limiting and overvoltage protection could be added with little effort. ■

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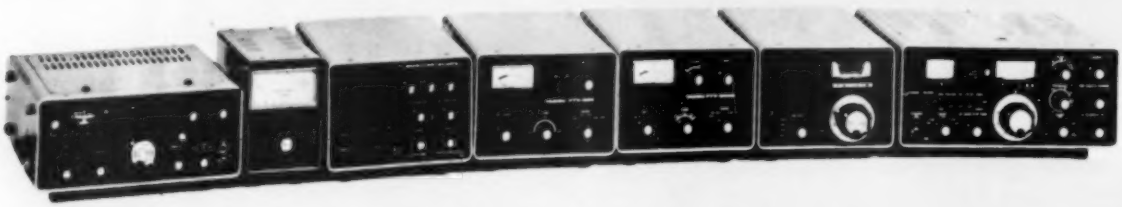

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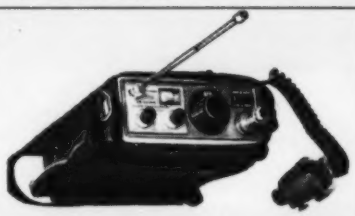

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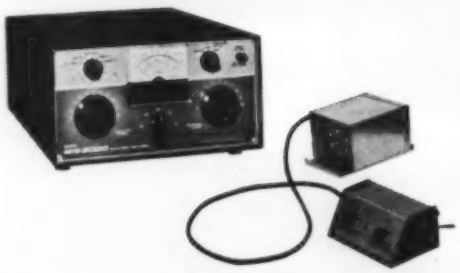

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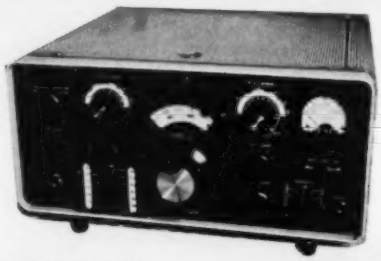
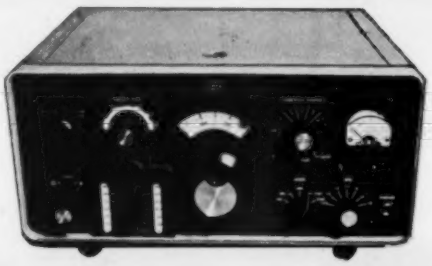
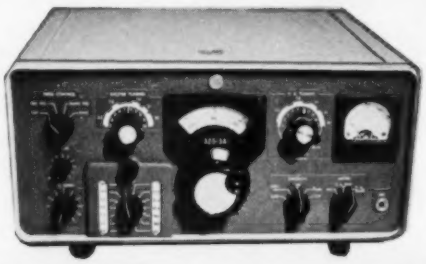


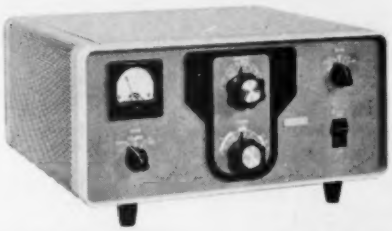
KWM-2A TRANSCEIVER **$3533.00**
Unmatched for mobile and fixed station applications. 175W on SSB, 160W on CW. Switch select up to 14 optional Xtals. Can be used for RTTY. Filter type SSB generation. Automatic load control. Inverse RF feedback. Reimeability-tuned variable oscillator.



75S-3C RECEIVER **$2504.00**
Sharp selectivity. SSB, CW and RTTY. Single control rejection tuning. Variable BFO. Optional mechanical filters for CW, RTTY and AM. 2.1 KHz mechanical filter. Zener regulated oscillators. 3-position AGC.



32S-3A TRANSMITTER **$2597.00**
Covers all ham bands between 3.4 MHz and 30 MHz. Nominal output of 100W. 175W, SSB and 160W CW. Dual conversion. Automatic load control. RF inverse feedback. CW spotting control. Collins mechanical filter.



30L-1 LINEAR AMPLIFIER **$1536.00**
1000 watts PEP on SSB and 1000 Average on CW. Single control rejection tuning (50 dB). Variable BFO. 2.1 kHz Mechanical filter. Zener regulated oscillators. 3 position AGC. Exclusive comparator circuit.

312B-3 SPEAKER
$80.00

312B-4
SPEAKER CONSOLE
$546.00

312B-5 VFO CONSOLE
$1212.00

516F-2 AC POWER SUPPLY
$440.00

302C-3 DIRECTIONAL WATT METER
$360.00

DL-1 DUMMY LOAD
$270.00

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BIRD THRULINE® WATTMETER

MODEL 43

- BUY ONLY THE ELEMENTS YOU NEED AND ADD EXTRA RANGES AT ANY TIME
- READ RF WATTS DIRECTLY

Table 1
STANDARD ELEMENTS

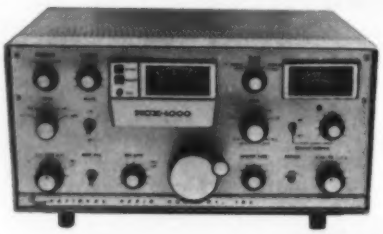
Power Range	Frequency Bands (MHz) 2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

Table 2
LOW-POWER ELEMENTS

1 watt	Cat. No.	2.5 watts	Cat. No.
60-80 MHz	060-1	60-80 MHz	060-2
80-95 MHz	080-1	80-95 MHz	080-2
95-125 MHz	095-1	95-150 MHz	095-2
110-160 MHz	110-1	150-250 MHz	150-2
150-250 MHz	150-1	200-300 MHz	200-2
200-300 MHz	200-1	250-450 MHz	250-2
275-450 MHz	275-1	400-850 MHz	400-2
425-850 MHz	425-1	800-950 MHz	800-2
800-950 MHz	800-1		

WE HAVE A COMPLETE STOCK OF ALL BIRD WATTMETERS AND SLUGS

NATIONAL RADIO COMPANY, INC. NRCI



NCX-1000

The only 1000 watt, "single package" transceiver. Heavy duty design . . . results of 50 years of design leadership in amateur equipment. State of the art speech processing, linear amplifier, power supply, all in one package. Nothing extra to buy. Covers all amateur bands in the HF spectrum . . . AM, SS' CW'

$1,600

NCL-2000

Linear Amplifier. A full 10 dB gain. 20 watts in 2000 watts out. Can be driven with one watt. Continuous duty design utilizes two 8122 ceramic tetrode output tubes, designed for both AM and SSB operation. The industry standard for 12 years. Thousands in use all over the world.

$1,200

HRO-500

The ultimate short wave receiver. This synthesized (phase lock loop) receiver incorporates all facilities for AM, Single Side Band (SSB), and CW reception in all frequencies from the bottom of the very low frequency band (VLF) to the top of the high frequency band (HF). National's "dead accurate" dial means no searching for transmissions. Dial up the frequency and it's there: aeronautical, marine, CB, amateur, military, etc. Continuous coverage.

$3,000

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ICOM

VHF/UHF AMATUER & MARINE EQUIPMENT

VHF/UHF AMATEUR & MARINE EQUIPMENT

IC-245. 146 MHz FM 10W XCVR. LSI synthesizer with 4 digit LED readout. Xmit & Rcv frequencies independently programmable. 60 dB spurious attenuation.

$499.00

IC-215. 2 METER FM PORTABLE. Three narrow filters for superb performance. 3W or 400 mW. 15 CH. capacity. MOS FET RF Amp & 5 tuned ckts. S-meter front panel.

$229.00

$249.00

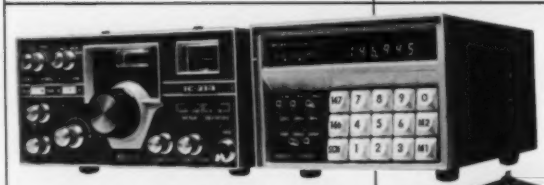
IC-502. 6 METER SSB & CW PORTABLE XCVR. Includes antenna & battery pack. 3W PEP & stable VFO for fun & FB QSO's. Covers first 800 KHz of 6M band, where most activity is.

IC-211. 4 MEG, MULTI-MODE 2M XCVR. 144-145 MHz on SSB & CW, plus 146-147 MHz on FM. Work AMAT OSCAR six or seven. LSI synthesizer with 7 digit LED. MOS FET RF Amp, 5 helical cavities, FET mixer & 3 I.F. filters.

$749.00

$299.00

IC-22S. 145 MHz FM 10W XCVR. CMOS synthesizer can be set to any 15 KHz ch. between 146 & 148 MHz by diode matrix board. Spurious attenuation far better than FCC spec. 10W or 1W. IDC modulation control.



IC-21A. 146 MHz FM 10W XCVR. MOS FET RF Amp & 5 helical resonator filter, plus 3 I.F. filters. IDC modulation control. Variable output pwr: 500 MW to 10W Front panel discriminator meter. SWR bridge. 117 VAC and 13.6 VDC pwr supplies.

$399.00

DV-21. DIGITAL VFO. Use with IC-21A to complete 2M band.

$299.00

IC-202. 2 METER SSB PORTABLE XCVR. Puts sideband in your hand! Internal C batteries or external 12 VDC. 3W PEP. True I.F. noise blanker. 144.0, 144.2 on two other 200 KHz bands, selectable. Hamtronics stocks 145.2 and 145.8 - 146.0 MHz for calling frequency & satellite band.

$259.00

IC-30A. 450 MHz FM LOW XCVR. 1W or 10W. Low noise MOS-FET RF Amp & 5 section helical filter. 22 CH. capacity. S-meter & relative power output meter. IDC modulation control.

$399.00

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TEMPO ONE	HF Transceiver. 80-10M. USB, CW & AM	399.00
AC/ONE	Power Supply for TEMPO ONE	99.00
VF/ONE	External VFO for TEMPO ONE	109.00
TEMPO VHF/ONE	Transceiver. 2M. 144 yo 148 MHz. PLL	399.00
TEMPO SSB/ONE	SSB Adapter for TEMPO VHF/ONE	199.00
TEMPO 2020	Transceiver. 80-10M. USB, LSB, CW and AM. PLL. Digital	759.00
FMH	2W, VHF/FM, 6 Ch. Hand Held. 144-148 MHz	199.00
RBF-1	Wattmeter & SWR Bridge	42.95
DM-20	Desk Mike. 600 or 50K ohm. PTT & Lock Switches	39.00
MS-2	4 Ch. Pocket Scanning Rcvr.	99.00

ATLAS

210X	Transceiver. 10-80M. 200W	679.00
215X	Transceiver. 15-160M. 200W	679.00
OMK	Deluxe Mtg. Kit for 210X & 215X	48.00
220CS	AC Console for 210X & 215X	149.00
350-XL	Transceiver. SSB. Solid State. 10-160M. 350W.	995.00
DD6-XL	Digital Dial Readout for 350-XL	195.00
305	Plug-In Auxiliary VFO. For 350-XL	155.00
311	Plug-In Auxiliary Crystal Oscillator for 350-XL	135.00
350-PS	AC Pwr Supply w/Spkr & Phone Jack for 350-XL	195.00
DMK-XL	Mobile Mounting Bracket for 350-XL. Easy Plug-In	65.00

SWAN

700 CX	Transceiver. 700W PEP. SSB. 80-10M. USB, LSB or CW	649.95
VX-2	Plug-In VOX for 700 CX	44.95
SS-16B	Super Selective IF Filter for 700 CX	99.95
MARK II	Linear Amplifiere Full Legal Power. W/100W input. 80-10 M.	849.95
1200 X	Portable Linear Amplifier. 1200W PEP. SSB. 700W, Ch. 300W, AM. 80-10M.	349.95
FP-1	Hybrid Telephone Patch. Connect Rcvr/Xmitter to Phone lines	64.95

FC-76	Frequency Counter. 5 Digit LED	169.95
WM6200	In-Line Presicion Wattmater for 2M. 2 Scales to 200W. Reads SWR.	59.95
FS-2	SWR & Field Strength Meter	15.95
SWR-3	Pocket SWR Meter	12.95
SWR-1A	Relative Power Meter & SWR Bridge	25.95
W2000	In-Line Wattmeter. 3 Scales to 2000W. 3.5 to 30 MHz	59.95
WM-3000	Peak/RMS Wattmeter. Tells The Truth About SSB	79.95
FS-1	Pocket Field Strength Meter	10.95
WM1500	In-Line Wattmeter. 4 Scales to 1500W. 2 to 50 MHz	74.95
MARK II	Linear Amplifier. Full Legal Power. W/100W input. 80-10 M.	849.95
1200 X	Portable Linear Amplifier. 1200W PEP. SSB. 700W, CW. 300W, AM. 80-10M.	349.95

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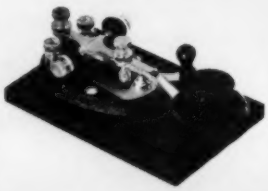
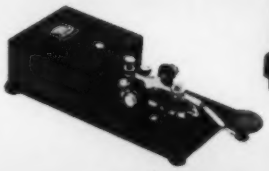
NYE VIKING

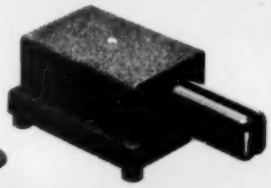
No. 114-310-003 $8.25



No. 114-310-004GP $50.00



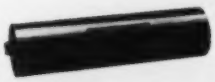
No. 114-404-002 $18.50



No. SSK-1 $23.95

No. 250-46-1 $36.50

No. 250-46-3 $44.50



No. 250-20-1 $19.95

No. 250-0025-003 $212

NPC

2.5 AMP

12CB4 29.95

4 AMP

103R 39.95

6 AMP

104R 49.95

12 AMP

108 RM
99.95

25 AMP

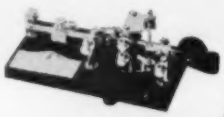
109R 149.95

VIBROPLEX

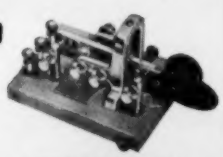
"PRESENTATION"
66.00

"ORIGINAL"
39.95

"LIGHTNING BUG"
39.95



"CHAMPION"
31.50



VIBRO-KEYER
33.00

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DenTron 3 Kilowatt Tuner Matches Everything From 160 to 10

160-10 MAT

Built-In Wattmeter

Front Panel Antenna Selector for Coax, Balanced Line and Random Wire.

only $229.50

1000 to 1200 WATTS OUTPUT TO YOUR ANTENNA

DenTron SUPER AMP

$499.50

If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI shielding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4 - 811 A's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all at $499.50.

NOW AVAILABLE WITH 572 B's FOR **$574.50**

DenTron Super Tuner

160-10 Meters
Balanced Line,
Coax, Random
or Long Wire

Maximum Power Transfer, Xmitter to Antenna.

1 KW Model $129.50 3 KW Model $229.50

DenTron ANTENNAS

The Sky Openers

SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one cleverly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and sealed HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	50
80	200
40	entire band

Tuning is easy and reliable. Rugged construction assures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds.. Handles full legal power limit.

$79.50

EX-1

The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantastic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

$129.50

ALL BAND DOUBLET

This All Band Doublet or inverted Type Antenna covers 160 thru 10 meters. Has total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 450 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

DenTron ANTENNA TUNER

The 80-10 Skymatcher

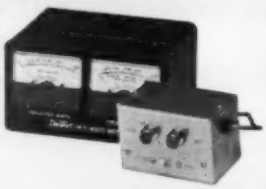
Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- SO-239 receptionel to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W. 5" H. 8" D., Weight: 5 lbs.

$59.50

DenTron W-2 PAD INLINE WATTMASTER

Read forward and reflected watts at the same time



Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

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TEN-TEC INC.

TRITON IV EQUIPMENT

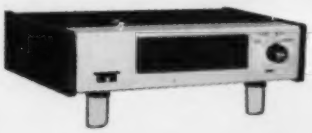
TRANSCEIVERS

MODEL 540-200W, SSB/CW
3.5 - 30 MHz $699.00

MODEL 544- DIGITAL, 200W
SSB/CW, 3.5 - 30 MHz
$869.00

MODEL 240 $97.00
ONE - SIXTY CONVERTER

MODEL 242 $169.00
REMOTE VFO



MODEL 244 $197.00
DIGITAL READ OUT/COUNTER

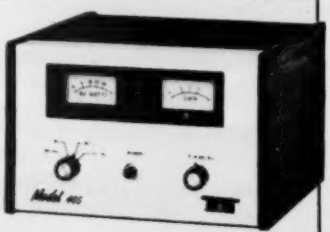
MODEL 262-G $129.00
DELUXE POWER SUPPLY

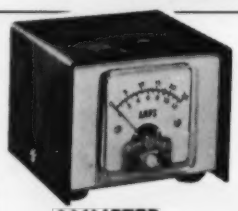
ARGONAUT

MODEL 509 $329.00
SW, SSB/CW, 3.5-30 MHz

LINEAR AMPLIFIER

MODEL 405 $159.00
100W, 3.5 - 30 MHz

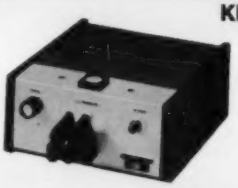




AMMETER
207 $14.00

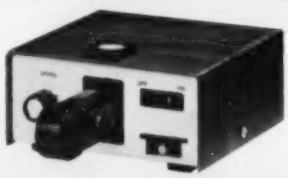
XTAL CALIBRATOR
206 $26.95

KEYERS

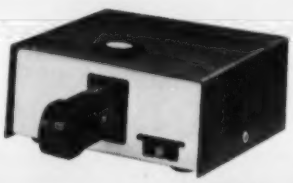


ELECTRONIC KR-50
$110.00

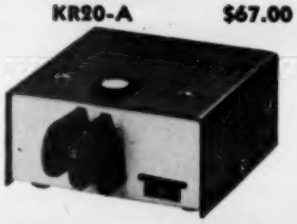
ELECTRONIC
KR20-A $67.00



ELECTRONIC KR-5A
$38.50



KR-2A $15.00



KR1-A $35.00

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Carl C. Drumeller W5JJ
5824 N.W. 58 Street
Warr Acres OK 73122

Yaesu FRG-7 Impressions

-- take note, SWL fans!

Manufacturers' specifications look very tempting. They can seem to provide the optimum solution to your radio receiving problems. And, remarkably enough, usually the specifications are accurate.

Dry figures, however, don't tell the story as well as hands-on intimacy. Unfortunately, it's seldom that one gets to take a prospective purchase home for a familiarization period before plunking down a wad of that green stuff. And once that green stuff has changed hands, often it's difficult to whistle it back!

That brings us to the subject of this article, one man's experience with a receiver that's new to the American market. Perhaps these experiences will assist you in making a decision as to whether the FRG-7 is your cup of tea.

First impressions are strong, often lasting. The first impression presented by the FRG-7, as it is being unwrapped from its heavy plastic cocoon, is that of exquisite neatness. It's packaged complete with every type of connector you could possibly need and even a hank of antenna for a random wire (called "longwire" by those who don't know their nomenclature) antenna for reception of signals your dipole might not pick up too well. Look at the front, and you'll be impressed by the orderly array of controls. Nothing is "Mickey Mouse." Yaesu has been making high quality transceivers too long to half-mast its standards!

The instruction book, unlike that of many imports, is written by a person familiar with the English language. It's not quite as complete in detail as one might like, and is really a far cry from those put out by the E. F. Johnson Company before it deserted amateur radio for the dazzling dollars of CB. It's not too skimpy, though, and contains a pull-out diagram that can be read easily without the aid of a magnifying glass! From the list of recommended test equipment for servicing, one gets the impression that Yaesu would like for owners to keep their hands out of the receiver's innards. That's probably founded on past experiences with other solid state products!

It takes only a few minutes to absorb the simple operating procedures. You set the controls for the frequency band desired . . . and snap on a thumb-sized toggle switch. And, as an aside, unlike most Japanese-manufactured radio receivers, that toggle switch is in the primary of the power transformer, not in the "B+" lead!

I hope you do your initial listening either on AM phone or on CW. It works quite acceptably on both of those. But if your first try is on SSB, you may conclude that you made a regrettable mistake in judgment when you bought a Yaesu FRG-7! Let's face it. The combination of 1000 kHz per band with a dial that has a backlash of 100 Hz makes getting a voice to sound intelligible, let alone natural, an exacting task! It can be done, as improbable as that may appear initially. On top of those two characteristics, the receiver has an uncanny affinity for AM carriers. Comparing it with a Drake TR-4C on the 7150-7300 kHz segment discloses far greater interference from carriers (even during daytime reception) on the FRG-7. This test was made by switching the dipole from one receiver to the other with a coax switch.

The ceramic filter used in the final i-f of the FRG-7 really is not suited for SSB reception in crowded amateur bands.

Switching to a shortwave broadcast band quickly alters the unfortunate opinions that one may have formed while attempting to hear SSB signals. It performs quite creditably. The audio quality, of course, will not satisfy a "hi-fi" fan, but the limited frequency response stems from the comparatively-sharp i-f selectivity.

It's hard to fault the receiver's performance on CW. It tunes easily. It's rock-stable. It has a choice of three audio response curves. In short, it's a honey!

You'll notice I've omitted any listing of specifications, presuming you've looked over that information, scanning catalogues or dealers' handouts. I've just given you my impressions. For many years I've used only Drake or Collins receivers. The FRG-7 plainly is not in the same league as these. And, of course, at $299.00, you really can't expect it to be. If one comes down out of the clouds and sheds any delusions of getting three thousand dollars worth of receiver for three hundred dollars, he just may find the FRG-7 a very satisfying bit of equipment. Don't look for perfection; you won't find it! But if you look for a full-coverage receiver that'll do an excellent job of receiving CW, a very good job of receiving AM voice, and an acceptable (after you've gotten used to it) job of receiving amateur SSB signals — one that doesn't cost an arm and a leg — you'll have to search far and wide before you find one that'll top the Yaesu FRG-7. ■

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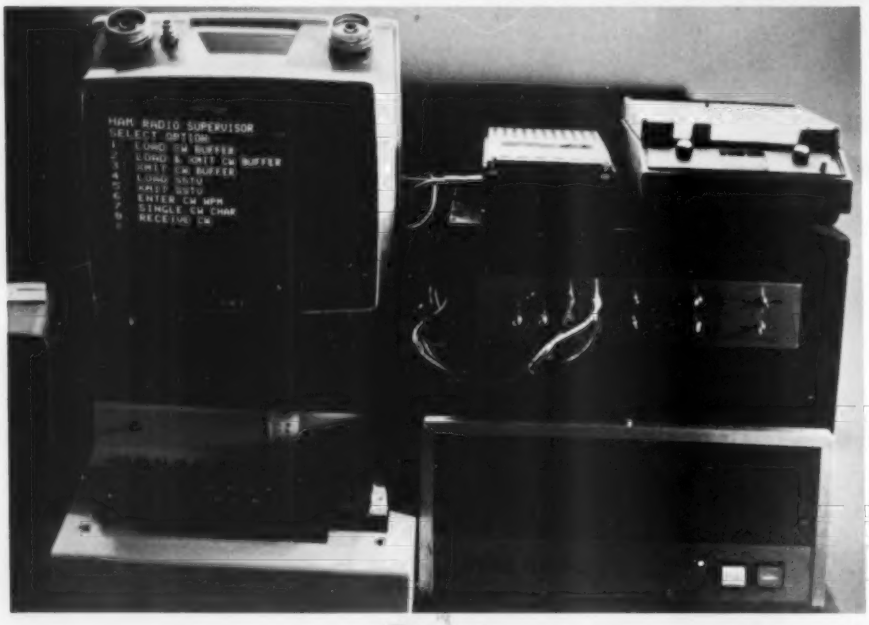
SSTV Meets the SWTP 6800

-- modulate video with a micro

Soon after completion of my SWTPC 6800 system, I thought, "Now what can I do with it?" Since my hobby is ham radio coupled with an interest in SSTV, the answer was obvious. I decided to start in a small way with a program to load my WØLMD SSTV keyboard (Ref. 1). This project was quite successful, and I next attempted a more ambitious one – to generate SSTV in the CPU main memory. It became obvious that to generate SSTV I must first slow the microprocessor way down to accomplish the proper timings. I started by writing a short feasibility program which generated timing pulses and video in the proper relationships. I fed these pulses into an SSTV modulator which uses only three ICs and is external to the SWTPC 6800 system. This program's performance exceeded my expectations; however, it had one large drawback. The picture dot patterns had to be entered a byte at a time into the main memory which was a big job. This article tells about my third program, which automatically loads memory and generates SSTV pictures.



The system.

00	00	F0	80	00	00	FF

Fig. 1. Hexadecimal representation of seven picture dots in memory.

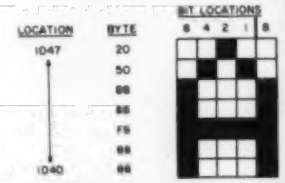


Fig. 2. Coding of the dots to form the letter A.

Memory Location	Present Value	Name
031A	75 (Hex)	Number of lines/ picture Half frame = 45
02E3	80 (Hex)	Horizontal line freq. 80 = 15 Hz (USA) 70 = 16-2/3 (Europe)
02E4	5D (Hex)	Sync pulse width Horizontal = 5 ms Vertical = 30 ms

Table 1.

Sample SSTV generation with some unwanted ac ripple sneaking into the monitor to mess things up!

The Specifications

I think a short technical discussion is in order as to how I accomplish this. I first decided on a few basic specifications which were taken from my WØLMD keyboard design. These were:

1. An SSTV picture will contain 30 ASCII characters in a 5 x 7 dot matrix pattern.
2. An SSTV picture dot will consist of three scan lines (vertical) and 1 dot (horizontal).
3. An SSTV picture will consist of 117 scan lines.
4. An SSTV scan line will consist of 7 eight bit bytes (6 data, 1 sync).
5. An SSTV picture in the SWTPC 6800 memory will consist of 819 bytes (117 lines x 7 bytes/line).

As you can see from these specifications, the memory requirements are quite negligible and my first feasibility program fits easily into the 4K of memory provided with the basic SWTPC 6800 system.

Well, now that we have a set of specifications, how is the programming accomplished? The only programming language which makes sense in this application is assembly language. The 6800 assembly language instructions coupled with the use of MIKBUG makes programming the SWTPC 6800 system an easy task. My first job was to flowchart the entire program, which is a highly recommended practice for anyone attempting such a project.

The Seven "Picture Bytes" – and the Software

Now let's examine in general how the seven picture bytes are used to generate the various sync pulses or picture dots. An example is shown in Fig. 1.

The example represents a typical SSTV scan line in memory. The first operation the program does in the transmit mode is load from memory the first byte into an accumulator. The accumulator in the 6800 is a powerful register which can be used to add, compare, or shift data. This byte is compared to see if it is FF. If it is, then it is a sync pulse. If not, it must be a data byte. The accumulator is then shifted to the left a bit at a time. If the shifted bit is a one, then bit 0 of the parallel interface adaptor (PIA) is turned on.

If the bit is zero, then the interface bit is turned off. If the byte is a sync byte (FF), then interface bit 2 is turned on for 5 or 30 milliseconds. Sound easy? Well, it is. All that is required is to connect these pulses to an SSTV modulator and out come SSTV pictures. Obviously, programming delays must be executed between all steps. Three program constants control all of these delays: one for the horizontal line frequency, one for the sync pulse durations, and one for the number of scan lines. Just think of the possibilities! By manipulating these constants, any number of scan lines can be transmitted (up to 117) at any frequency, which is only limited by the CPU cycle time and memory speed.

The generation of the SSTV is quite easy; the biggest trick is to place the correct dots in the picture at the correct location. This is accomplished by use of a translate table and a dot table. The translate table is used to tell the program

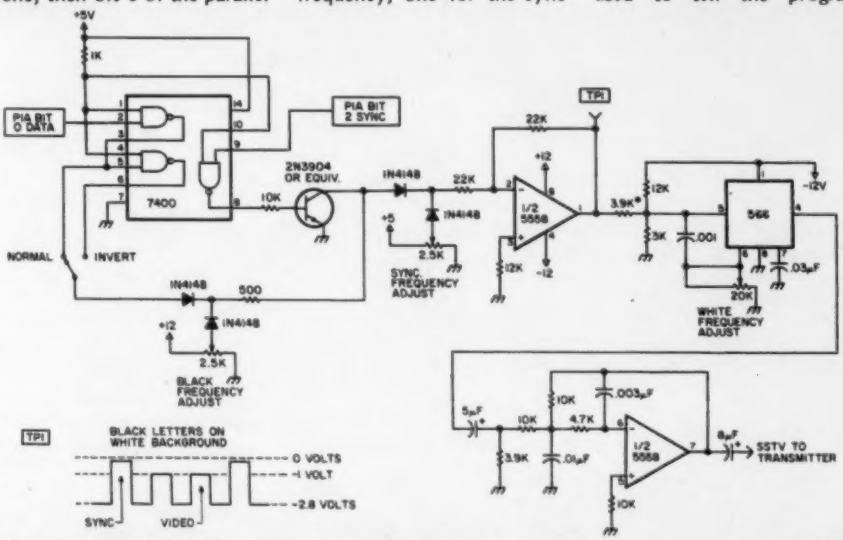


*Fig. 3. SSTV modulator schematic. *Adjust value of resistor if required for correct SSTV frequency swing.*

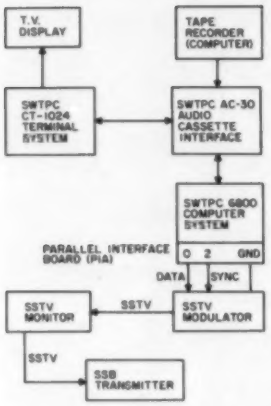


Fig. 4. Block diagram of computer hardware interconnections.

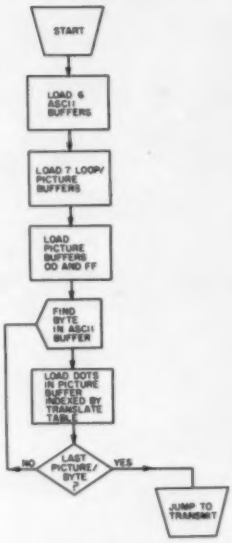


Fig. 5. Load SSTV picture program flowchart.

Another sample (along with the ripple).

where in the dot table the correct dots are located. The dot table is a 5 x 7 ASCII dot matrix array of bytes. The character dots were taken from the specification sheet of the 2513 Character Generator ROM chip (Ref. 2). Not all characters (ASCII) were coded in this program, due to their uncommon usage. The translate table in this program allows for expansion of 13 dot patterns without rewrite of my generator routines. The reader can code any of the patterns to suit his needs. In order to accomplish this task, I should explain in detail how the various tables are coded. Fig. 2 is an example of how to code the dots for the letter A.

As you can see, you are only limited by your imagination. With a little ingenuity, a set of graphic-like dot patterns can be created. The translate table in memory is contiguous with the dot table. The low order address of the translate table is equivalent to 6 of the 8 ASCII code bits. For example, let's take the letter A. The ASCII code for A is 41 hex. If you strip off the 8 and 4 bits, the code remaining is 01 hex. If you look in the translate table location 1D01 (hex), you will find a 47. This value means that the address of the dot bytes for A are located at 1D47 in memory. You will find in the translate table (1D00 to 1D3F) a number of 04 characters. This value is a blank character and is placed on numbers with ASCII codes between 21 and 2D. The characters are rarely used and 13 of these codes can be used for special graphics. The character codes (ASCII) 5B-5F will load characters with an inverted VEE. Now that you have a rough idea of how the program operates, let's use it.

The program makes a few assumptions about how your 6800 system is configured:

The PIA card is in location 7 (address 801C).

MIKBUG or equivalent is used, with the following routines: E07E – output a string of characters; E1D1 – output a single character; E1AC – input a single character.

At least 8K of memory.

PIA bits 0 are data pulses and bits 2 are sync pulses.

The PIA can be changed easily on any bit convenient on your system. Some of the program constants which can be modified to fit your specific requirements are shown in Table 1.

The program can be executed by loading MIKBUG location A048 and A049 with 0000 and typing G. The first routine executed is LOAD. This routine loads the picture buffers as you type in. The first message printed on the TV terminal is:

PICTURE FORMATS 0-5
1 2 3 4 5

The program is now asking for you to load 5 lines of 6 characters each. You first type in the picture number you want to load followed by 30 characters. The first character of each line will be placed under its corresponding line number.

You can now load all 6 pictures or type an ASCII letter to end the process. The next message printed on the TV terminal screen is:

SELECT LOOPS-PICTURES
LOOP MAX=9
?

The program is now asking

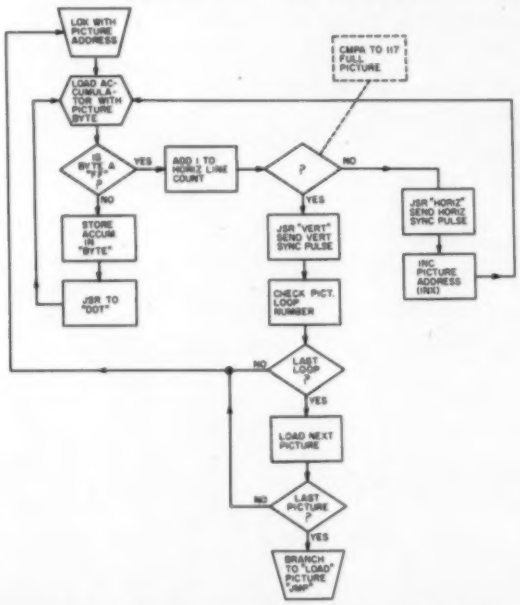


Fig. 6. Transmit SSTV picture program flowchart.

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```
STMT  LOC   OBJECT M  SOURCE STATEMENT

                     TITLE  SSTV3
                     PIA    EQU    H'801C        PIA ADDRESS
                     OUT    EQU    H'E07E        MIKBUG  OUTPUT
                     OUTEEE EQU    H'E1B1        MIKBUG OUTPUT
                     INEEE  EQU    H'E1AC        INPUT A CHARACTER
                            ORG    H'0000
                     ********************************************************
                     ***          THIS PROGRAM LOADS AND GENERATES SLOW
                     ***          SCAN AMATEUR RADIO (SSTV) PICTURES.
                     ***            4  PICTURES ARE GENERATED PROGRAM RUNS ON A
                     ***          SWTPC 6800 SYSTEM. PROGRAM WRITTEN BY:
                     ***          C W ABBARS (K6AEP) SAN JOSE , CALIF. 3/10/77
                     ********************************************************
0000  CE 0020 A LOAD   LDX    #MENU1        PRINT PICTURE MENU1
0003  BD E07E A        JSR    OUT           LOAD ASCII BUFFER
0006  BD 0275 A        JSR    BUFF          CHECK FOR LOOP
0009  8A 027A A        LDAA   BYTE1         MASK OUT 4 LOWER BITS
000C  84 F0           ANDA   #H'F0         ASCII NUMBER ?
000E  81 30           CMPA   #H'30         BRANCH TO SEND
0010  27 EE           BEQ    LOAD
0012  CE 0055 A        LDX    #MENU2        PRINT PICTURE MENU2
0015  BD E07E A        JSR    OUT           PICTURE/LOOP ROUTINES
0018  BD 68           BSR    LOOP          LOAD PICTURE DOTS
001A  BD 00EA A        JSR    NUM           BRANCH TO SEND
001D  7E 027B A        JMP    SEND
0020        19  MENU1  PCB    H'19          HOME UP
0021        16         PCB    H'16          CLEAR SCREEN
0022        0D         PCB    H'0D          CARRIAGE RETURN
0023        5049       CHAR   /PICTURE FORMATS 0-5/
            4954
            4655
            5320
            5532
            2030
            4A2F
            4154
            3320
            3020
            2020
            2020
            2020
            2020
            2020
            2020
            2020
            3035
0032        0A                PCB    H'0A
0033        0D                PCB    H'0D
0034        04                PCB    H'04          END PRINT
0035        10         MENU2  PCB    H'10
0036        16         .      PCB    H'16
0037        0D                PCB    H'0D
0038        5345              CHAR   /SELECT LOOPS-PICTURES/
            4C45
            4354
            2050
            4943
            5455
            5245
            2D50
            4943
            5455
            5245
            5329
003C        53                PCB    H'0A
003D        0A                PCB    H'0D
003E        0D                CHAR   /LOOP MAX=9/
003F        4C4F
            4F50
            204D
            4158
            3D39
0044        3A                PCB    H'0A
0045        0D                PCB    H'0D
0046        3F                CHAR   /?/
0047        04                PCB    H'04          END PRINT
                     ********************************************************
                     ***          LOOP- THIS ROUTINE LOADS THE LOOP
                     ***          COUNT AND PICTURE BUFFERS TO BE
                     ***          TRANSMITTED
                     ********************************************************
0048        00         CNT4   FCB    0             TEMP LOOP PROG COUNT
0049        00         CNT5   FCB    0             TEMP PICTURE NUMBER
004A        00         CNT6   FCB    0             TIMES LOOP BUFFER IS LOADED
004B        0000 A     DATA1  FDB    0             ADDRESS OF LOOP BUFFER
004D  7F 0039 A  LOOP   CLR    CNT6
0050  BD E1AC A  LOOP1  JSR    INEEE
0053  97 7D            STAA   CNT4          STORE LOOP ASCII CHAR
0055  86 2F            LDAA   #H'2F         ASCII SLASH
0057  BD E1B1 A         JSR    OUTEEE        PRINT SLASH
005A  96 7D            LDAA   CNT4
005C  84 F0            ANDA   #H'F0
005E  81 30            CMPA   #H'30         IS CHARACTER A NUMBER ?
0060  27 01            BEQ    LOOP2
0062  39               RTS
0063  BD E1AC A  LOOP2  JSR    INEEE
0066  97 7E            STAA   CNT5          STORE PICTURE ASCII
0068  84 0F            ANDA   #H'0F         STRIP OFF ASCII 30
006A  97 7E            STAA   CNT5
006C  96 7D            LDAA   CNT4
006E  84 0F            ANDA   #H'0F         STRIP OFF ASCII 30
0070  97 7D            STAA   CNT4
0072  96 7D            LDAB   CNT4
0074  C1 00            CMPB   #0
0076  27 1E            BEQ    LOOP3         IF 1ST TIME LOAD BUFF ADDRESS
0078  DE 93     LOOP5  LDX    DATA1         LOAD X WITH NEXT ADDRESS
007A  96 7D            LDAA   CNT4
007C  A7 00            STAA   X             STORE IN BUFFER LOOP
007E  08               INX
007F  96 7E            LDAA   CNT5
0081  A7 00            STAA   X             STORE PICTURE IN BUFFER
0083  08               INX
0084  DF 80            STX    DATA1         STORE NEW ADDRESS
0086  7C 007F A        INC    CNT6          ADD 1 TO CNT6
0089  96 7F            LDAA   CNT6
008B  81 07            CMPA   #7
008D  27 05            BEQ    LOOP4         IF 7 RETURN
008F  86 20            LDAA   #H'20         ASCII SPACE
0091  BD E1B1 A         JSR    OUTEEE        PRINT A SPACE
0094  20 BA            BRA    LOOP1         GET NEXT LOOP NUMBER
0096  CE 0003 A  LOOP3  LDX    #LPBUF        LOAD BUFFER ADDRESS
0099  DF 80            STX    DATA1         STORE IN TEMP ADDRESS
009B  20 DB            BRA    LOOP5
009D  39         LOOP4  RTS
009E  0006       LPBUF  RMB    14            LOOP AND PRINT BUFFER AREA (1 EXTRA)
                     ********************************************************
                     ***          NUM- THIS ROUTINE TAKES ASCII CHAR FROM
                     ***          THE 7 CHARACTER BUFFERS AND PLACES THE CORRECT
                     ***          DOTS IN THE PICTURE BUFFERS
                     ********************************************************
00A1        00         CNT3   FCB    0             DOTS TO BE LOADED
00A2        0000 A     CNT7   FDB    0             ADDRESS OF PICTURE
00A4        0000 A     CNT8   FDB    0             ADDRESS OF ASCII BUFFER
00A6        06         CNT9   FCB    0             CURRENT ASCII CHARACTER
00A7        00         CNT10  FCB    0             NUMBER OF ASCII BYTES
00A8        0000 A     CNT12  FDB    0             ADDRESS OF DOTS IN TABLE
00AA  BD 0199 A  NUM    JSR    LPS           ZERO DOTS WITH SYNC PULSE
00AD  00 79      NUM4   BRA    FAP
00AF  B4 0167 A         LDAA   CNT13
00B2  81 06             CMPA   #6
00B4  27 6D             BEQ    NUM5
00B6  7F 00E7 A         CLR    CNT10
00B9  7C 00E7 A         INC    CNT10         SET UP CHARACTER COUNT
00BC  DE E4      LBA    LDX    CNT8          LOAD ADDRESS OF 1ST PICTURE
00BE  A6 00             LDAA   X
00C0  97 E6             STAA   CNT9          STORE BYTE IN CNT9
00C2  BD 01CA A         JSR    FSLA          FIND ADDRESS OF SL PUT IN CNT12
00C5  BD 0259 A         JSR    LNB1
00C8  BD 0288 A         JSR    SL11          SCAN LINE 1
00CB  BD 0254 A         JSR    LND           LOAD NEXT DOTS
00CE  BD 0218 A         JSR    SL12
00D1  BD 029A A         JSR    LND
00D4  BD 0223 A         JSR    SL13
00D7  BD 029A A         JSR    LND
00DA  BD 023E A         JSR    SL14
00DD  BD 029A A         JSR    LND
00E0  BD 0259 A         JSR    SL15
00E3  BD 025A A         JSR    LND
00E6  BD 0244 A         JSR    SL16
00E9  BD 029A A         JSR    LND
00EC  BD 0267 A         JSR    SL17
00EF  96 E7             LDAA   CNT10
00F1  7C 00E7 A         INC    CNT10
00F4  81 04             CMPA   #4
00F6  27 1C             BEQ    NUM1
00F8  81 0C             CMPA   #12
00FA  27 18             BEQ    NUM1
00FC  81 1C             CMPA   #18
00FE  27 14             BEQ    NUM1
0100  81 18             CMPA   #24
0102  27 10             BEQ    NUM1
0104  81 1E             CMPA   #30
0106  27 16             BEQ    NUM2
0108  DE E2             LDX    CNT7
010A  08                INX                  INCRIMENT ADDRESS IN X
010B  DF E2             STX    CNT7
010D  DE E4             LDX    CNT8
010F  08                INX                  INCRIMENT ADDRESS IN A
0110  DF E4             STX    CNT8
0112  20 AB             BRA    LBA
0114  BD 0264 A  NUM1   JSR    ADD1
0117  DE E4             LDX    CNT8
0119  08                INX                  INCRIMENT ADDRESS IN X
011A  DF E4             STX    CNT8
011C  20 9E             BRA    LBA
011E  7C 0167 A  NUM2   INC    CNT13         SET UP TO LOAD NEXT BUFFER
0121  20 9A             BRA    NUM4          LOAD NEXT BUFFER RTS IF LAST
0123  7F 0167 A  NUM5   CLR    CNT13         CLEAR BUFFER LOAD COUNT
0126  39                RTS
                     ********************************************************
                     ***          FAP- THIS ROUTINE SETS UP THE ADDRESSES FOR
                     ***          THE LOADING OF ALL PICTURE BUFFERS. PROGRAM
                     ***          BRANCHES TO MAIN LINE WHEN COMPLETED
                     ********************************************************
0127        00         CNT13  FCB    0             CURRENT BUFFER TO LOAD
0128  B6 0167 A  FAP    LDAA   CNT13
012B  81 06             CMPA   #6            IS IT 6 TH BUFFER?
012D  27 3A             BEQ    FAP6          IF SO RETURN TO MAIN LINE
012F  81 00             CMPA   #0
0131  27 14             BEQ    FAP0
0133  81 01             CMPA   #1
0135  27 1B             BEQ    FAP1
0137  81 02             CMPA   #2
0139  27 22             BEQ    FAP2
013B  81 03             CMPA   #3
013D  27 29             BEQ    FAP3
013F  81 04             CMPA   #4
0141  27 30             BEQ    FAP4
0143  81 05             CMPA   #5
0145  27 37             BEQ    FAP5
0147  CE 1C00 A  FAP0   LDX    #$00          ASCII BUFFER
014A  DF E4             STX    CNT8
014C  CE 0464 A         LDX    #1124         PICTURE BUFFER
014F  DF E2             STX    CNT7
0151  39                RTS
0152  CE 1C1E A  FAP1   LDX    #$1E
0155  DF E4             STX    CNT8
0157  CE 0797 A         LDX    #1943
015A  DF E2             STX    CNT7
015C  39                RTS
015D  CE 1C3C A  FAP2   LDX    #$2
0160  DF E4             STX    CNT8
0162  CE 0ACA A         LDX    #2762
0165  DF E2             STX    CNT7
0167  39                RTS
0168  CE 1C5A A  FAP3   LDX    #$3
016B  DF E4             STX    CNT8
016D  CE 0DFB A         LDX    #3581
0170  DF E2             STX    CNT7
0172  39                RTS
0173  CE 1C78 A  FAP4   LDX    #$4
0176  DF E4             STX    CNT8
0178  CE 1139 A         LDX    #4400
017B  DF E2             STX    CNT7
017D  39                RTS
017E  CE 1C96 A  FAP5   LDX    #$5
0181  DF E4             STX    CNT8
0183  CE 1443 A         LDX    #5219
0186  DF E2             STX    CNT7
0188  39                RTS
0189  39        FAP6   RTS
                     ********************************************************
                     ***          FSLA THIS ROUTINE TAKES AN ASCII BYTE IN
                     ***          CNT9 AND PUTS THE ADDRESS OF ITS DOTS
                     ***          IN CNT12
                     ********************************************************
018A  96 E6      FSLA   LDAA   CNT9          CURRENT BYTE
018C  84 3F             ANDA   #H'3F         STRIP OFF & AND 4 BITS
018E  CE 1D00 A         LDX    #H'1D00       LDX WITH TRANSLATE TABLE
0191  B7 0195 A         STAA   FSLA1+1
0194  E6 00      FSLA1  LDAB   X              TRANSLATE TABLE OFFSET IN B
0196  96 E6             LDAA   CNT9
0198  84 40            ANDA   #H'40
019A  81 40             CMPA   #H'40         IS IT AN ASCII LETTER ?
019C  27 09             BEQ    FSLA2         IF SO BRANCH
019E  F7 01E3 A         STAB   FSLA3+2
01A1  CE 1E00 A  FSLA3  LDX    #H'1E00
01A4  DF E8             STX    CNT12
01A6  39                RTS
01A7  F7 01EC A  FSLA2  STAB   FSLA4+2
01AA  CE 1D08 A  FSLA4  LDX    #H'1D08
01AD  DF E8             STX    CNT12
01AF  39                RTS
                     ********************************************************
                     ***          THIS ROUTINE SETS UP BLANK DOT
                     ***          WITH TIMING PULSES (LPS) ROUTINE
                     ********************************************************
01B0  CE 0464 A  LPB    LDX    #1124         PICTURE 0 ADDRESS
01B3  4F         LP1    CLRA
01B4  C6 06             LDAB   #6            6 BYTES BLANK
01B6  A7 00      LP2    STAA   X             STORE 0
01B8  08                INX
01B9  5A                DECB
01BA  C1 00             CMPB   #0            ARE 6 BYTES STORED ?
01BC  27 02             BEQ    LP3
01BE  20 F6             BRA    LP2
01C0  86 FF      LP3    LDAA   #H'FF         SYNC PULSES
01C2  A7 00             STAA   X
01C4  08                INX
01C5  8C 1796 A         CPX    #$0D3B        PICTURE 5 END ADDRESS
01C8  27 03             BEQ    LP5
01CA  20 E7             BRA    LP1           STORE NEXT BYTE
01CC  39         LP5    RTS                  RETURN
                     ********************************************************
                     ***          SCAN LINE ROUTINES, PLACES DOTS IN
                     ***          THREE LINES
                     ********************************************************
01CD  96 E1      SL11   LDAA   CNT3          SCAN LINE 1 LOAD
01CF  DE E2             LDX    CNT7
01D1  A7 00             STAA   X
01D3  A7 07             STAA   7,X
01D5  A7 0E             STAA   14,X
01D7  39                RTS
01D8  96 E1      SL12   LDAA   CNT3          SCAN LINE 2 LOAD
01DA  DE E2             LDX    CNT7
01DC  A7 19             STAA   25,X
01DE  A7 1C             STAA   28,X
01E0  A7 23             STAA   35,X
01E2  39                RTS
01E3  96 E1      SL13   LDAA   CNT3          SCAN LINE 3 LOAD
01E5  DE E2             LDX    CNT7
01E7  A7 2A             STAA   42,X
01E9  A7 31             STAA   49,X
01EB  A7 38             STAA   56,X
01ED  39                RTS
01EE  96 E1      SL14   LDAA   CNT3          SCAN LINE 4 LOAD
01F0  DE E2             LDX    CNT7
01F2  A7 3F             STAA   63,X
01F4  A7 46             STAA   70,X
01F6  A7 4D             STAA   77,X
01F8  39                RTS
01F9  96 E1      SL15   LDAA   CNT3          SCAN LINE 5 LOAD
01FB  DE E2             LDX    CNT7
01FD  A7 54             STAA   84,X
01FF  A7 5B             STAA   91,X
0201  A7 62             STAA   98,X
0203  39                RTS
0204  96 E1      SL16   LDAA   CNT3          SCAN LINE 6 LOAD
0206  DE E2             LDX    CNT7
```

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0248  A7 69          STAA  105,X
024A  A7 70          STAA  112,X
024C  A7 77          STAA  119,X
024E  39             RTS
024F  96 E1    SLL7  LDAA  CNT3          SCAN LINE 7 LOAD
0251  BE E2          LDX   CNT7
0253  A7 7E          STAA  126,X
0255  A7 85          STAA  133,X
0257  A7 8C          STAA  140,X
0259  39             RTS
                     ********************************************************
                     ***          LND LOAD NEXT DOTS IN CNT12             ***
                     ********************************************************
025A  7C 00E9 A LND   INC   CNT12+1      INCRIMENT ADDRESS OF SL DOTS
025D  BE E8     LND1  LDX   CNT12        LOAD X WITH ADDRESS OF DOTS
025F  A6 00           LDAA  X            LOAD SL DOTS IN A
0261  97 E1           STAA  CNT3         STORE SL DOTS IN CNT3
0263  39              RTS
                     ********************************************************
                     ***          ADD1 LOAD +1&3 TO CNT7                  ***
                     ********************************************************
0264  BE E3     ADD1  LDX   CNT7         LOAD ADDRESS OF PICTURE
0266  5F             CLRB                CLEAR B
0267  08       AD1   INX
0268  5C             INCB
0269  C1 A3          CMPB  #163          CHECK FOR 163 TIME
026B  27 02          BEQ   AB2           IF SO BRANCH
026D  20 F8          BRA   AD1           ADD NEXT COUNT
026F  DF E2     AB2   STX   CNT7          STORE NEW ADDRESSS
0271  39              RTS
                     ********************************************************
                     ***          BUFF THIS ROUTINE SETS UP AND LOADS THE ASCII
                     ***          CHARACTER BUFFERS                       ***
                     ********************************************************
0272        0000 A DATA   FDB   0          BUFFER CHARACTER ADDRESS
0274        00     BYTE1  FCB   0          BUFFER INPUT BYTE
0275  BD E1AC A BUFF   JSR   INEEE         GET A CHARACTER
0278  B7 0274 A         STAA  BYTE1        STORE A BYTE
027B  81 30             CMPA  #"0"
027D  27 2C             BEQ   BUFF0
027F  81 31             CMPA  #"1"
0281  27 30             BEQ   BUFF1
0283  81 32             CMPA  #"2"
0285  27 34             BEQ   BUFF2
0287  81 33             CMPA  #"3"
0289  27 38             BEQ   BUFF3
028B  81 34             CMPA  #"4"
028D  27 3C             BEQ   BUFF4
028F  81 35             CMPA  #"5"
0291  27 40             BEQ   BUFF5
0293  81 36             CMPA  #"6"
0295  27 44             BEQ   BUFF6
0297  39        BUFF  RTS
0298  5F       BUFN  CLRB
0299  BD E1AC A BUF1   JSR   INEEE
029C  FE 0272 A         LDX   DATA         LOAD INDEX WITH BUFFER ADDRESS
029F  A7 00             STAA  X            STORE CHARACTER IN BUFFER
02A1  5E                INCB               INC CHARACTER COUNT
02A2  7C 0273 A         INC   DATA+1       INC BUFFER ADDRESS
02A5  C1 1E             CMPB  #30          IS IT THE 30TH CHARACTER ?
02A7  27 EE             BEQ   BUFF2
02A9  20 EE             BRA   BUF1
02AB  CE 1CB0 A BUFF0   LDX   #$B0
02AE  FF 0272 A         STX   DATA
02B1  20 E5             BRA   BUFN
02B3  CE 1C1E A BUFF1   LDX   #$1
02B6  FF 0272 A         STX   DATA
02B9  20 DD             BRA   BUFN
02BB  CE 1C3C A BUFF2   LDX   #$2
02BE  FF 0272 A         STX   DATA
02C1  20 D5             BRA   BUFN
02C3  CE 1C5A A BUFF3   LDX   #$3
02C6  FF 0272 A         STX   DATA
02C9  20 CD             BRA   BUFN
02CB  CE 1C78 A BUFF4   LDX   #$4
02CE  FF 0272 A         STX   DATA
02D1  20 C5             BRA   BUFN
02D3  CE 1C96 A BUFF5   LDX   #$5
02D6  FF 0272 A         STX   DATA
02D9  20 BD             BRA   BUFN
02DB  CE 1CB4 A BUFF6   LDX   #$6
02DE  FF 0272 A         STX   DATA
02E1  20 B5             BRA   BUFN
                     ********************************************************
                     ***          SEND- THIS PROGRAM GENERATES SSTV PICTURES
                     ***          PREVIOUSLY LOADED INTO SIX BUFFERS      ***
                     ********************************************************
02E3        88     MSEC  FCB   136        DOT DELAY(160 MZ VIDEO)
02E4        56     PUL1  FCB   95         PULSE WIDTH DELAY
02E5        00     BYTE  FCB   0          TEMP BYTE STORAGE
02E6        00     CNT1  FCB   0          CHAR DOT COUNT
02E7        00     CNT2  FCB   0          HORIZ LINE COUNT
02E8        0000 A PIC1  FDB   0          PICTURE START ADDRESS
02EA        0000 A PIC2  FDB   0          TEMP NEXT BYTE ADDRESS
02EC        00     CNT14 FCB   0          TEMP LOOP THRU PROGRAM
02ED        00     CNT15 FCB   0          TEMP LOOP
02EE        0000 A CNT16 FDB   0          NEXT LOOP/PICT ADDRESS
02F0  7F 02C7 A SEND  CLR   CNT2         INITIALIZE HORIZ LINE COUNT
02F3  7F 02EC A         CLR   CNT16
02F6  7F 02ED A         CLR   CNT14
02F9  BD 0304 A         JSR   LOOPN        SET UP PICTURE/LOOP
02FC  FE 02E8 A         LDX   PIC1
02FF  A6 00     SEND1   LDAA  X
0301  FF 02EA A         STX   PIC2
0304  81 FF             CMPA  #$FF         SYNC PULSE ?
0306  27 0B             BEQ   SEND2        HORIZ OR VERT PULSE
0308  B7 02E5 A         STAA  BYTE         STORE DOTS IN BYTE
030B  BD 4A             BSR   DOT          TRANSMIT DOTS
030D  FE 02EA A         LDX   PIC2
0310  08                INX
0311  20 EC             BRA   SEND1
0313  7C 02E7 A SEND2   INC   CNT2         INC LINE COUNT
0316  B6 02E7 A         LDAA  CNT2
0319  81 7B             CMPA  #117         IS IT A FULL PICTURE ?
031B  27 0B             BEQ   SEND3        VERT SYNC
031D  BD 0B12           BSR   HORIZ        SEND A HORIZ SYNC PULSE
0319  FE 02EA A         LDX   PIC2
0322  08                INX                INCRIMENT DOT ADDRESS
0323  FF 02EA A         STX   PIC2
0326  20 D7             BRA   SEND1
0328  BD 03B7 A SEND3   JSR   VERT         SEND VERT SYNC PULSE
032B  7C 02ED A         INC   CNT14        LOOP THRU PICTURE
032E  B6 02ED A         LDAA  CNT14
0331  B6 7D             LDAB  CNT6         PROGRAMMED LOOP
0333  11                CBA
0334  27 08             BEQ   SEND4
0336  7F 02E7 A         CLR   CNT2         RESET HORIZ LINE COUNT
0339  FE 02E8 A         LDX   PIC1
033C  20 C1             BRA   SEND1
033E  FE 02EE A SEND4   LDX   CNT15        NEXT BUFFER ADDRESS
0341  96 7F             LDAA  CNT6         NUMBER OF LOOP/PICT LOADED
0343  F6 02EC A         LDAB  CNT16        ACTUAL COUNT TRANSMITTED
0346  11                CBA
0347  27 0B             BEQ   SEND5        LAST PICTURE
0349  BD 038A A         JSR   LOOPN1       LOAD NEXT LOOPS
034C  7F 02E7 A         CLR   CNT2
034F  FE 02E8 A         LDX   PIC1         LOAD X WITH PICTURE ADDRESS
0352  20 AB             BRA   SEND1
0354  7E 0000 A SEND5   JMP   LOAD         NEXT LOAD
                     ********************************************************
                     ***          DOT THIS ROUTINE GENERATES PICTURE DOTS  ***
                     ********************************************************
0357  7F 02E6 A DOT     CLR   CNT1
035A  7C 02E6 A DOT1    INC   CNT1
035D  4F                CLRA
035E  B6 02E5 A         LDAA  BYTE         GET CURRENT BYTE
0361  49                ROLA               SHIFT A LEFT
0362  B7 02E5 A         STAA  BYTE         STORE RESULTS
0365  25 0C             BCS   DOT2         CHARACTER DOT
0367  20 1A             BRA   DOT3         NO DOT
0369  F6 02E3 A DELAY   LDAB  MSEC         DOT ON/OFF DELAY
036C  5A        DEL1    DECB
036D  C1 00             CMPB  #0
036F  27 09             BEQ   RET1
0371  20 F9             BRA   DEL1
0373  86 01     DOT2    LDAA  #1           LOAD 1 PIA BIT 0
0375  B7 801C A         STAA  PIA          TURN ON PIA BIT
0378  20 EF             BRA   DELAY
037A  F6 02E6 A RET1    LDAB  CNT1         LOAD CHAR BIT COUNT
037D  C1 05             CMPB  #5           IS IT BIT 5 ?
037F  27 09             BEQ   RET2         IF SO GET NEXT CHARACTER
0381  20 07             BRA   DOT1         GET NEXT BIT
0383  86 00     DOT3    LDAA  #0           LOAD 0 NEXT BITS
0385  B7 801C A         STAA  PIA
0388  20 DF             BRA   DELAY
038A  86 00     RET2    LDAA  #0
038C  B7 801C A         STAA  PIA          TURN OFF PIA BIT
038F  F6 02E3 A         LDAB  MSEC         CHAR SPACE DELAY
0392  5A        DEL3    DECB
0393  C1 00             CMPB  #0
0395  27 02             BEQ   RET4         RETURN TO PROGRAM
0397  20 F9             BRA   DEL3
0399  39        RET4    RTS
                     ********************************************************
                     ***          HORIZ - THIS ROUTINE TRANSMITTS HORIZ SYNC PULSES
                     ********************************************************
039A  86 04     HORIZ   LDAA  #4           LOAD A BIT 2
039C  B7 801C A         STAA  PIA          SET PIA
039F  B6 04             LDAA  #4           DO LOOP 4 TIMES
03A1  F6 02E4 A HOR4    LDAB  PUL1         APPROX 1 MS DELAY LOOP
03A4  5A        HOR1    DECB
03A5  C1 00             CMPB  #0
03A7  27 02             BEQ   HOR2
03A9  20 F9             BRA   HOR1
03AB  4A        HOR2    DECA
03AC  81 00             CMPA  #0
03AE  27 02             BEQ   HOR3
03B0  20 EF             BRA   HOR4
03B2  4F        HOR3    CLRA
03B3  B7 801C A         STAA  PIA          RESET PIA
03B6  39                RTS
                     ********************************************************
                     ***          VERT- THIS ROUTINE TRANSMITTS VERT SYNC PULSES
                     ********************************************************
03B7  86 04     VERT    LDAA  #4           LOAD A BIT 2
03B9  B7 801C A         STAA  PIA          SET PIA
03BC  86 1E             LDAA  #30          DO LOOP 30 TIMES
03BE  F6 02E4 A VER4    LDAB  PUL1         1 MSEC DELAY LOOP
03C1  5A        VER1    DECB
03C2  C1 00             CMPB  #0
03C4  27 02             BEQ   VER2
03C6  20 F9             BRA   VER1
03C8  4A        VER2    DECA
03C9  81 00             CMPA  #0
03CB  27 02             BEQ   VER3
03CD  20 EF             BRA   VER4
03CF  4F        VER3    CLRA
03D0  B7 801C A         STAA  PIA          RESET PIA
03D3  39                RTS
                     ********************************************************
                     ***          LOOPN- THIS SUBROUTINE SETS UP PROGRAM LOOPS AND
                     ***          PICTURE BUFFERS PREVIOUSLY LOADED       ***
                     ********************************************************
03D4  7F 02EC A LOOPN   CLR   CNT16
03D7  CE 00B5 A         LDX   #LPBUF
03DA  A6 00     LOOPN1  LDAA  X
03DC  97 7D             STAA  CNT4         LOOP NUMBER
03DE  08                INX
03DF  A6 00             LDAA  X
03E1  97 7E             STAA  CNT5         PICTURE NUMBER
03E3  08                INX
03E4  FF 02EE A         STX   CNT15
03E7  7C 02EC A         INC   CNT16        INC TRANSMIT PICTURE COUNT
03EA  7F 02ED A         CLR   CNT14        CLEAR LOOP COUNT
03ED  96 7E             LDAA  CNT5
03EF  81 00             CMPA  #"0"
03F1  27 14             BEQ   W8
03F3  81 01             CMPA  #"1"
03F5  27 19             BEQ   W1
03F7  81 02             CMPA  #"2"
03F9  27 1C             BEQ   W2
03FB  81 03             CMPA  #"3"
03FD  27 20             BEQ   W3
03FF  81 04             CMPA  #"4"
0401  27 24             BEQ   W4
0403  81 05             CMPA  #"5"
0405  27 28             BEQ   W5
0407  CE 0464 A W8      LDX   #1124
040A  FF 02E8 A         STX   PIC1
040D  20 28             BRA   LOOPN2
040F  CE 0797 A W1      LDX   #1943
0412  FF 02E8 A         STX   PIC1
0415  20 20             BRA   LOOPN2
0417  CE 0ACA A W2      LDX   #2762
041A  FF 02E8 A         STX   PIC1
041D  20 18             BRA   LOOPN2
041F  CE 0DFD A W3      LDX   #3581
0422  FF 02E8 A         STX   PIC1
0425  20 10             BRA   LOOPN2
0427  CE 1130 A W4      LDX   #4400
042A  FF 02E8 A         STX   PIC1
042D  20 08             BRA   LOOPN2
042F  CE 1463 A W5      LDX   #5219
0432  FF 02E8 A         STX   PIC1
0435  20 00             BRA   LOOPN2
0437  39        LOOPN2  RTS
1C00                    ORG   $1C00
1C00        001E        RMB   30
1C1E        001E        RMB   30
1C3C        001E        RMB   30
1C5A        001E        RMB   30
1C78        001E        RMB   30
1C96        001E        RMB   30
1CB4        0012        RMB   30
                        END

SYMBOL TABLE:

AD1   0267 A  AD2   0367 A  ADD1  0264 A  B0    1C00 A
B1    1C1E A  B2    1C3C A  B3    1C5A A  B4    1C78 A
B5    1C96 A  B6    1CB4 A  BUF1  0299 A  BUF2  029F A
BUFF  0275 A  BUFF0 02AB A  BUFF1 02B3 A  BUFF2 02BB A
BUFF3 02C3 A  BUFF4 02CB A  BUFF5 02D3 A  BUFF6 02DB A
BUFN  0298 A  BYTE  02E5 A  BYTE1 0274 A  CNT1  02E6 A
CNT12 00E8 A  CNT13 0147 A  CNT14 02ED A  CNT15 02EE A
CNT16 02EC A  CNT2  02E7 A  CNT3  00E1 A  CNT4  007D A
CNT5  007E A  CNT6  007F A  CNT7  00E2 A  CNT8  00E4 A
DATA  0272 A  DEL1  0369 A  DEL3  0392 A  DOT   0357 A
DOT1  035A A  DOT2  0373 A  DOT3  0383 A  FAP   0168 A
FAP0  0187 A  FAP1  0192 A  FAP2  0190 A  FAP3  01AB A
FAP4  01B2 A  FAP5  01D2 A  FAP6  01C9 A  FSLA  01CA A
FSLA1 01D4 A  FSLA2 01E7 A  FSLA3 01E1 A  FSLA4 01EA A
HOR1  03A4 A  HOR2  03AB A  HOR3  03B2 A  HOR4  03A1 A
HORIZ 039A A  INEEE 01AC A  LBA   009C A  LND   0258 A
LND1  025D A  LOAD  0000 A  LOOP  0B82 A  LOOP1  0B85 A
LOOP2 0B98 A  LOOP3 0BCB A  LOOP4 0BD2 A  LOOP5 0BAD A
LOOPN 03D4 A  LOOPN1 03DA A  LOOPN2 0437 A  LP0   01F0 A
LP1   01F3 A  LP2   01F6 A  LP3   0200 A  LP5   020C A
LPBUF 00B5 A  MENU1 0228 A  MENU2 0B95 A  MSEC  02E3 A
N8    0487 A  N1    0497 A  N2    04A7 A  N3    04B7 A
N4    04C7 A  N5    04DB A  NUM   00EA A  NUM1  0194 A
NUM2  015E A  NUM4  00E9 A  NUM5  0163 A  OUT   E07E A
OUTEE E101 A  PIA   801C A  PIC1  02E8 A  PIC2  02EA A
PUL1  02E4 A  RET1  037A A  RET2  038A A  RET4  0399 A
SEND  02F0 A  SEND1 02FF A  SEND2 0313 A  SEND3 0328 A
SEND4 033E A  SEND5 0354 A  SLL1  0280 A  SLL2  0218 A
SLL3  0223 A  SLL4  022E A  SLL5  0239 A  SLL6  0244 A
SLL7  024F A  VER1  03C1 A  VER2  03C8 A  VER3  03CF A
VER4  03BE A  VERT  03B7 A

CHECKSUM = 0303

LENGTH OF DSECT =     0 (0000)
LENGTH OF ISECT =     0 (0000)

        NO ERRORS.  NO WARNINGS. THIS ASSEMBLY
```

Program A. Source listings for SSTV generation program.

you to type in the number of times each SSTV picture is transmitted. For example, a 3 loop would transmit approximately 24 seconds (3 x 8) of SSTV. The program will then respond with a slash after you enter the loop number. It will then wait for the picture you have just loaded (0-5). You

```
0000 CE 00 20 BD E0 7E BD 02 75 B6 02 74 84 F0 81 30
0010 27 EE CE 00 55 BD E0 7E BD 68 BD 00 EA 7E 02 F0
0020 10 16 0D 50 49 43 54 55 52 45 20 46 4F 52 4D 41
0030 54 53 20 30 2D 35 0A 0D 20 31 20 20 20 20 20 32
0040 20 20 20 20 20 33 20 20 20 20 20 34 20 20 20 20
0050 20 35 0A 0D 04 10 16 0D 53 45 4C 45 43 54 20 4C
0060 4F 4F 50 53 2D 50 49 43 54 55 52 45 53 0A 0D 4C
0070 4F 4F 50 20 4D 41 58 3D 39 0A 0D 3F 04 00 00 00
0080 00 00 7F 00 7F BD E1 AC 97 7D 86 2F BD E1 D1 96
0090 7D 84 F0 81 30 27 01 39 BD E1 AC 97 7E 84 0F 97
00A0 7E 96 7D 84 0F 97 7D D6 7F C1 00 27 1E DE 80 96
00B0 7D A7 00 08 96 7E A7 00 08 DF 80 7C 00 7F 96 7F
00C0 81 07 27 0E 86 20 BD E1 D1 20 BA CE 00 D3 DF 80
00D0 20 DB 39 84 20 DB 39 02 02 09 00 09 00 09 00 09
00E0 00 00 00 00 00 00 00 00 00 00 BD 01 F0 BD 79 86
00F0 01 67 81 06 27 6D 7F 00 E7 7C 00 E7 DE E4 A6 00

0100 97 E6 BD 01 CA BD 02 5D BD 02 0D BD 02 5A BD 02
0110 18 BD 02 5A BD 02 23 BD 02 5A BD 02 2E BD 02 5A
0120 BD 02 39 BD 02 5A BD 02 44 BD 02 5A BD 02 4F 96
0130 E7 7C 00 E7 81 06 27 1C 81 0C 27 18 81 12 27 14
0140 81 18 27 10 81 1E 27 16 DE E2 08 DF E2 DE E4 08
0150 DF E4 20 A8 BD 02 64 DE E4 08 DF E4 20 9E 7C 01
0160 67 20 8A 7F 01 67 39 00 B6 01 67 81 06 27 5A 81
0170 00 27 14 81 01 27 18 81 02 27 22 81 03 27 29 81
0180 04 27 30 81 05 27 37 CE 1C 00 DF E4 CE 04 64 DF
0190 E2 39 CE 1C 1E DF E4 CE 07 97 DF E2 39 CE 1C 3C
01A0 DF E4 CE 0A CA DF E2 39 CE 1C 5A DF E4 CE 0D FD
01B0 DF E2 39 CE 1C 78 DF E4 CE 11 30 DF E2 39 CE 1C
01C0 96 DF E4 CE 14 63 DF E2 39 39 96 E6 84 3F CE 1D
01D0 00 B7 01 D5 E6 00 96 E6 84 40 81 40 27 09 F7 01
01E0 E3 CE 1E 00 DF E8 39 F7 01 EC CE 1D 00 DF E8 39
01F0 CE 04 64 4F C6 06 A7 00 08 5A C1 00 27 02 20 F6

0200 86 FF A7 00 08 8C 17 96 27 02 20 E7 39 96 E1 DE
0210 E2 A7 00 A7 07 A7 0E 39 96 E1 DE E2 A7 15 A7 1C
0220 A7 23 39 96 E1 DE E2 A7 2A A7 31 A7 38 39 96 E1
0230 DE E2 A7 3F A7 46 A7 4D 39 96 E1 DE E2 A7 54 A7
0240 5B A7 62 39 96 E1 DE E2 A7 69 A7 70 A7 77 39 96
0250 E1 DE E2 A7 7E A7 85 A7 8C 39 7C 00 E9 DE E8 A6
0260 00 97 E1 39 DE E2 5F 08 5C C1 A3 27 02 20 F8 DF
0270 E2 39 00 00 00 BD E1 AC B7 02 74 81 30 27 2C 81
0280 31 27 30 81 32 27 34 81 33 27 38 81 34 27 3C 81
0290 35 27 40 81 36 27 44 39 5F BD E1 AC FE 02 72 A7
02A0 00 5C 7C 02 73 C1 1E 27 EE 20 EE CE 1C 00 FF 02
02B0 72 20 E5 CE 1C 1E FF 02 72 20 DD CE 1C 3C FF 02
02C0 72 20 D5 CE 1C 5A FF 02 72 20 CD CE 1C 78 FF 02
02D0 72 20 C5 CE 1C 96 FF 02 72 20 BD CE 1C B4 FF 02
02E0 72 20 B5 80 5D 00 00 00 00 00 00 00 00 00 00 00
02F0 7F 02 E7 7F 02 EC 7F 02 ED BD 03 D4 FE 02 E8 A6

0300 00 FF 02 EA 81 FF 27 0B B7 02 E5 8D 4A FE 02 EA
0310 08 20 EC 7C 02 E7 86 02 E7 81 75 27 0B 8D 7B FE
0320 02 EA 08 FF 02 EA 20 D7 BD 03 B7 7C 02 ED B6 02
0330 ED D6 7D 11 27 08 7F 02 E7 FE 02 E8 20 C1 FE 02
0340 EE 96 7F F6 02 EC 11 27 0B BD 03 DA 7F 02 E7 FE
0350 02 E8 20 AB 7E 00 00 7F 02 E6 7C 02 E6 4F B6 02
0360 E5 49 B7 02 E5 25 0C 20 1A F6 02 E3 5A C1 00 27
0370 09 20 F9 86 01 B7 80 1C 20 EF F6 02 E6 C1 05 27
0380 09 20 D7 86 00 B7 80 1C 20 DF 86 00 B7 80 1C F6
0390 02 E3 5A C1 00 27 02 20 F9 39 86 04 B7 80 1C 86
03A0 04 F6 02 E4 5A C1 00 27 02 20 F9 4A 81 00 27 02
03B0 20 EF 4F B7 80 1C 39 86 04 B7 80 1C 86 1E F6 02
03C0 E4 5A C1 00 27 02 20 F9 4A 81 00 27 02 20 EF 4F
03D0 B7 80 1C 39 7F 02 EC CE 00 D3 A6 00 97 7D 08 A6
03E0 00 97 7E 08 FF 02 EE 7C 02 EC 7F 02 ED 96 7E 81
03F0 00 27 14 81 01 27 18 81 02 27 1C 81 03 27 20 81

0400 04 27 24 81 05 27 28 CE 04 64 FF 02 E8 20 28 CE
0410 07 97 FF 02 E8 20 20 CE 0A CA FF 02 E8 20 18 CE
0420 0D FD FF 02 E8 20 10 CE 11 30 FF 02 E8 20 08 CE
0430 14 63 FF 02 E8 20 00 39 00 00 00 00 00 00 00 00
```

TRANSLATE AND DOT TABLES

```
1D00 40 47 4E 55 5C 63 6A 71 78 7F 86 8D 94 9B A2 A9
1D10 B0 B7 BE C5 CC D3 DA E1 E8 EF F6 40 40 40 40 40
1D20 04 04 04 04 04 04 04 04 04 04 04 04 04 04 58 08
1D30 12 19 20 27 2E 35 3C 43 4A 51 04 04 04 04 04 04
1D40 00 00 20 50 88 00 00 20 50 88 88 F8 88 88 F0 88
1D50 88 F0 88 88 F0 F0 88 80 80 80 88 F0 F0 88 88 88
1D60 88 88 F0 F8 80 80 F0 80 80 F8 F8 80 80 F0 80 80
1D70 80 78 80 80 80 98 88 78 88 88 88 F8 88 88 88 70
1D80 20 20 20 20 20 70 08 08 08 08 08 88 70 88 90 A0
1D90 C0 A0 90 88 80 80 80 80 80 80 F8 88 D8 A3 A8 88
1DA0 88 88 88 88 C8 A8 98 88 88 70 88 88 88 88 88 70
1DB0 F0 88 88 F0 80 80 80 70 88 88 88 A8 90 68 F0 88
1DC0 88 70 A0 90 88 70 88 80 70 08 88 70 F8 20 20 20
1DD0 20 20 20 88 88 88 88 88 88 70 88 88 88 88 88 50
1DE0 20 88 88 88 A8 A8 D8 88 88 88 50 20 50 88 88 88
1DF0 88 50 20 20 20 20 F8 08 08 20 40 80 F8 F8 F8 F8

1E00 F8 F8 F8 F8 00 02 00 00 00 00 00 00 08 10 20 40
1E10 80 00 70 88 98 A8 C8 88 70 20 60 20 20 20 20 70
1E20 70 88 08 30 40 80 F8 F8 08 10 30 08 88 70 10 30
1E30 50 90 F8 10 10 F8 80 F0 08 08 88 70 38 40 80 70
1E40 88 88 70 F8 08 10 20 40 40 40 70 88 88 70 88 88
1E50 70 70 88 88 78 08 10 E0 00 00 00 00 00 00 20 00
```

Program B. Hexadecimal object listings for SSTV generation program.

can enter up to 7 loops/pictures and the process can be terminated by entering an ASCII letter for the loop number. An SSTV picture can be looped up to 9 times. This type of programming will provide over 8 minutes of SSTV. Seven loop/pictures are entered with loop counts of 9. Upon entry of the 7 loop/pictures, the SSTV transmission is executed. After transmission, the program branches back to the load routine.

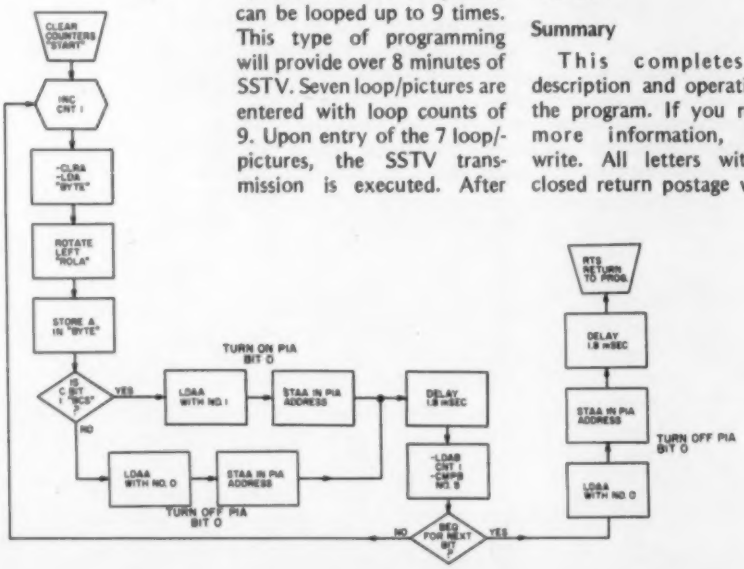

Fig. 7. Transmit SSTV picture dot program flowchart.

Summary

This completes the description and operation of the program. If you require more information, please write. All letters with enclosed return postage will be answered. Fig. 3 is an SSTV modulator which I use. The circuit was constructed on a vectorboard and installed in a minibox. The design is quite straightforward and can be duplicated with little cost and difficulty. The timing pulses are interfaced to the computer by a 7400 NAND gate. White letters on a black background or black letters on a white background are selected by an SPST switch. The video and sync pulses are mixed by 4 diodes, 1 IC, and 1 transistor. This video then drives a 566 function generator. The output triangular waveform is shaped into a sine wave by the output active filter.

Conclusion

Fig. 4 is a block diagram of the hardware configuration of my system. Figs. 5, 6, and 7 are flowcharts of the three

routines which make up the software. The flowcharts should be useful to anyone who wants to build this system around another microprocessor.

I hope you will enjoy using this SSTV generator. Over-the-air reports have indicated that the video is considerably more readable under QRM conditions than my WØLMD keyboard. The use of microprocessors are an obvious choice for the generation of SSTV. Considering that my special purpose SSTV keyboard is complex (44 ICs) and my SSTV 6800 generator runs on an unmodified SWTPC 6800 this proves that the microprocessor is the way to go for SSTV. ■

References

[1] "An SSTV keyboard," by Dr. Robert Sudding WØLMD, *CQ Magazine*, Sept., 1974, page 20.

[2] Signetics Corp., *Digital/Linear MOS IC Manual*, "2513 High Speed Character Generator Chip," pages 7-80 (1972 version).


```
S00F000020202020202020202020202070
S1210000CE0020BDE07EBD0275B6027484F0813027EECE0055BDE07E8D68BD00EA7EE3
S121001E02F010160D5049435455524520464F524D41545320302D350A0D20312020E9
S121003C2020203220202020203320202020203420202020203500A0D0410160D5345AE
S121005A4C454354204C4F4F50532D5049435455524553 0A0D4C4F4F50204D41583D7F
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S121009601 39BDE1AC977E840F977E967D840F977DD67FC100271EDE80967DA70008D2
S12100B4967EA70008DF8C7C007F967F8107270E8620BDE1D120BACE00D3DF8020DB51
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S12100E1000000000000000000BD01F08D79B601678106276D7F00E77C00E7DEE4A6DF
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S121011DBD025ABD0239BD025ABD0244BD025ABD024F96E77C00E78106271C810C270E
S121013B1881122714811827108 11E2716DEE208DFE2DEE408DFE420A8BD0264DEE44D
S1210159 08DFE4209E7C0167208A7F01673900B601678106275A8100271481012 71BA7
S12101778102272281032729810427308 1052737CE1C00DFE4CE0464DFE239CE1C1E21
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S12102 4969A770A7773996E1DEE2A77EA785A78C397C00E9DEE8A60097E139DEE25F27
S1210267085CC1A3270220F8DFE239000000BDE1ACB702748130272C813127308 1323B
S121028527348133273881342 73C8135274081362744395FBDE1ACFE0272A7005C7CBF
S12102A30273C11E27EE20EECE1C00FF027220E5CE1C1EFF027220DDCE1C3CFF02724F
S12102C120D5CE1C5AFF027220CDCE1C78FF027220C5CE1C96FF027220BDCE1CB4FF5B
S12102DF027220B5805D000000000000000000000007F02E77F02EC7F02EDBD03D4FE02
S12102FD02E8A600FF02EA81FF270BB702E58D4AFE02EA0820EC7C02E7B602E7817545
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S12103577F02E67C02E64FB602E549B702E5250C201AF602E35AC100270220F98601B5
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S1210393C100270220F9398604B7801C8604F602E45AC100270220F94A810027022058
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S12103ED967E810027148101271881022 71C810327208104272481052728CE0464FFF2
S121040B02E82028CE0797FF02E82020CE0ACAFF02E82018CE0DFDFF02E82010CE1175
S112042930FF02E82008CE1463FF02E8200039F8
S9030000FC
```

Program C. Paper tape format for SSTV generation program.

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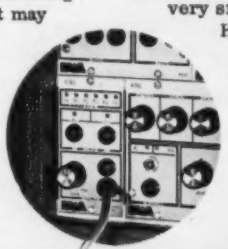

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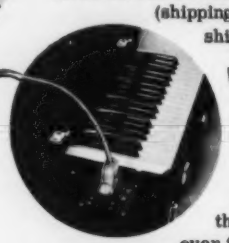

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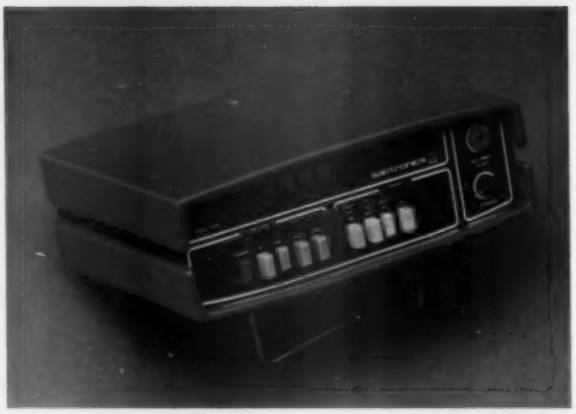

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Display: 9mm (.36") LED.
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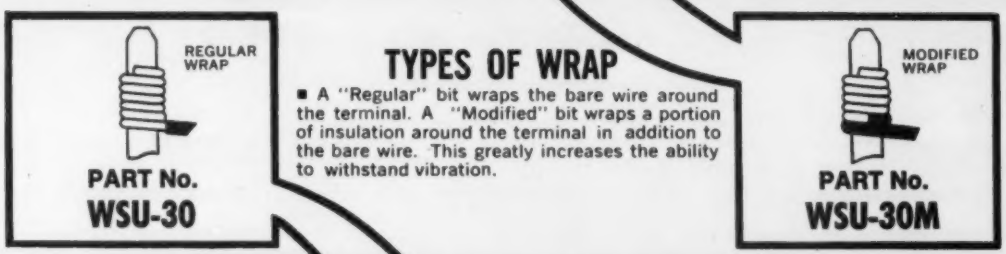
REGULAR WRAP
PART No.
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TYPES OF WRAP
■ A "Regular" bit wraps the bare wire around the terminal. A "Modified" bit wraps a portion of insulation around the terminal in addition to the bare wire. This greatly increases the ability to withstand vibration.
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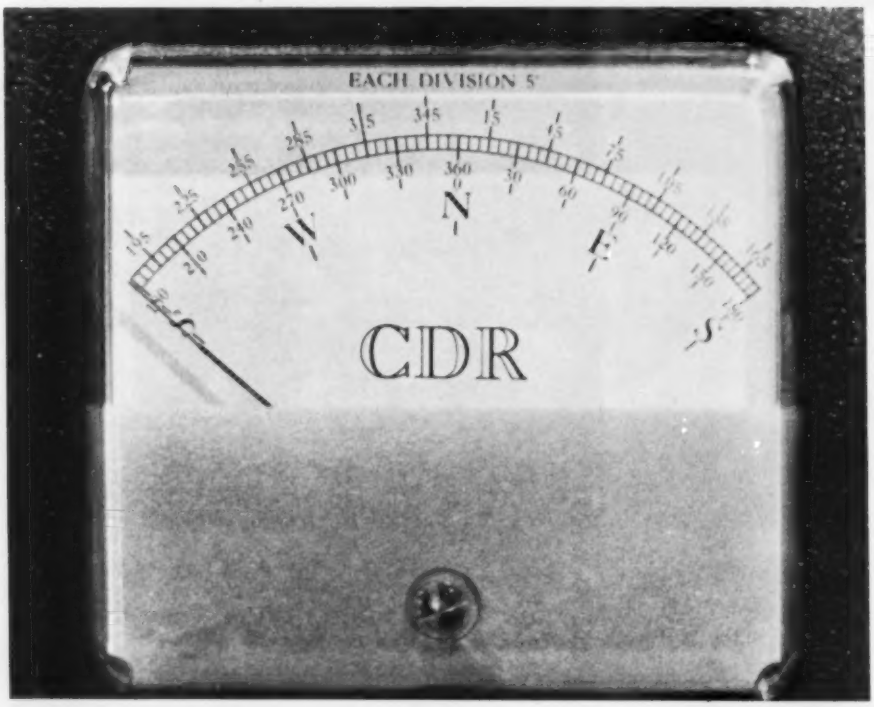


What direction?

This article describes a computer program that can provide accurate azimuth and distance information for properly aiming your beam antenna. Although the program was originally written in FORTRAN language for use with an IBM 370/155 computer, accessed through an IBM time-sharing terminal, the program is also presented in BASIC language. Also, the program can be modified to run on a microcomputer instead of through a time-sharing terminal.

Background

In the past year, several articles have appeared in *73 Magazine* describing methods of calculating beam bearing and distance. Two of these articles were "Aim your Beam Right" by WB4GVE (June, 1976) and "Global Calculations for the DXer" by W2IAT (August, 1976).

WB4GVE's article provided a method whereby azimuth information can be obtained using an HP-55 calculator. The basic azimuth equation is:

Degree Azimuth =

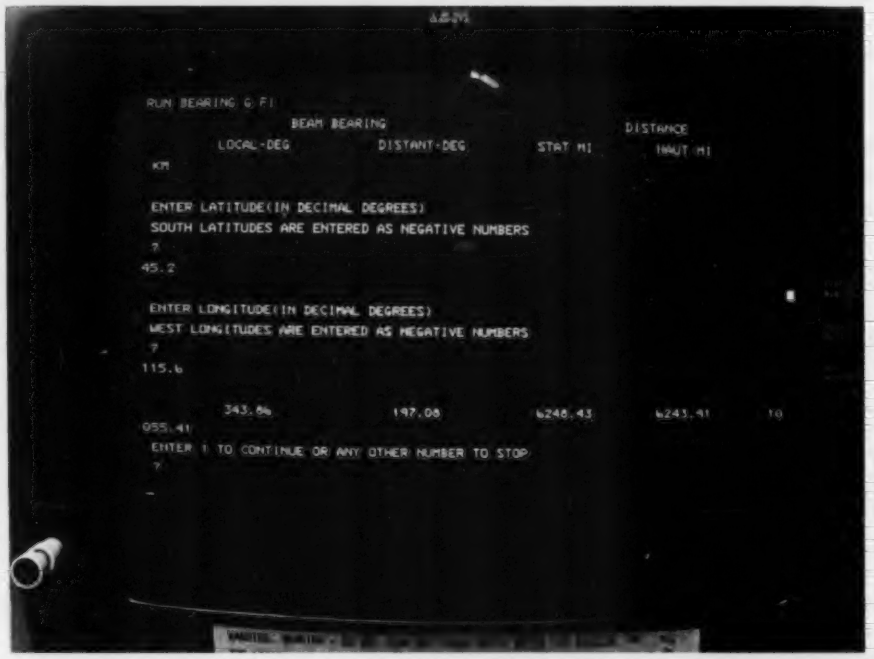
$$270^\circ + \tan^{-1}\left[\cos\lambda_1\left(\frac{\tan\lambda_1\cos(t_2-t_1)-\tan\lambda_2}{\sin(t_2-t_1)}\right)\right]$$

where:
λ_1 = latitude of your QTH
t_1 = longitude of your QTH
λ_2 = latitude of the distant QTH
t_2 = longitude of the distant QTH

W2IAT's article described a procedure for determining the distance in statute miles between two stations using a non-programmable calculator. The basic equation for calculating the distance between any two points along the earth's surface in statute miles is:

$$d = 69.052$$
$$z = \left[\cos^{-1}\left[(K_1)(\sin LAT_D) + (K_2)(\cos LAT_D)\cos(LON_D - LON_H)\right]\right]$$

where:
d = distance in statute miles
K_1, K_2 = constants determined by latitude of your QTH
LON_D = longitude of the distant QTH
LON_H = longitude of your QTH
LAT_D = latitude of the distant QTH



IBM 3277 time-sharing terminal.

It should be noted that the constant used (69.05) is not the same as used by W2IAT (69.15). The appropriate constant for statute miles may be found in "Radio Data Reference Book," Second Edition, Radio Society of Great Britain (RSGB), p. 103, and "Reference Data For Radio Engineers," Fifth Edition, Howard W. Sams & Co., pp. 26-10.

Development

Calculating beam bearing using a computer instead of a calculator provides several distinct advantages. For one thing, a computer system can provide a detailed printout of the results for later use. Another advantage is that,

An actual terminal screen display.

IBM 3284 printer.

```
10          WRITE (2,100)
20          WRITE (6,100)
30    100   FORMAT(' ',T19,'BEAM BEARING',T61,'DISTANCE')
40          WRITE(2,110)
50          WRITE(6,110)
60    110   FORMAT(' ',T10,'LOCAL-DEG',T30,'DISTANT-DEG',T50,'STAT MI',T65,'NA
70          1 UT MI',T82,'KM')
80          WRITE(2,120)
90          WRITE(6,120)
100   120   FORMAT(' ')
110   129   WRITE(6,130)
120   130   FORMAT(' ENTER LATITUDE(IN DECIMAL DEGREES)')
130         WRITE(6,140)
140   140   FORMAT(' SOUTH LATITUDES ARE ENTERED AS NEGATIVE NUMBERS')
150         READ(5,*)PLAM2
160         WRITE(6,160)
170   160   FORMAT(' ')
180         WRITE(6,170)
190   170   FORMAT(' ENTER LONGITUDE(IN DECIMAL DEGREES)')
200         WRITE(6,180)
210   180   FORMAT(' WEST LONGITUDES ARE ENTERED AS NEGATIVE NUMBERS')
220         READ(5,*)PL2
230         WRITE(6,190)
240   190   FORMAT(' ')
250         PIE=3.141592654
260         PLAM1=41.87*PIE/180.
270         PLAM2=PLAM2*PIE/180.
280         N=1
290         PL1=-87.63*PIE/180.
300         PL2=PL2*PIE/180.
310   105   CONTINUE
320         QP=COS(PLAM1)*((TAN(PLAM1)*COS(PL2-PL1))-TAN(PLAM2))/SIN(PL2-PL1)
330         X=270.+((180./PIE)*ATAN(QP))
340         IF((PL2-PL1).LE.0.)GO TO 202
350         IF((PL2-PL1).LE.PIE)X=X-180.
360   202   IF(N.EQ.2)GO TO 300
370         PL3=PL2
380         PL4=PL1
390         PL2=PL4
400         PL1=PL3
410         PLAM3=PLAM2
420         PLAM4=PLAM1
430         PLAM2=PLAM4
440         PLAM1=PLAM3
450         Y=X
460         N=2
470         GO TO 105
480   300   CONTINUE
490         C=ABS(PL2-PL1)
500         IF(C.GT.PIE)C=2.0*PIE-C
510         Z=ARCOS(SIN(PLAM1)*SIN(PLAM2)+COS(PLAM1)*COS(PLAM2)*COS(C))
520         Z=Z*180./PIE
530         A=69.05*Z
540         B=60.00*Z
550         E=111.12*Z
560   125   WRITE(2,150)Y,X,A,B,E
570         WRITE(6,150)Y,X,A,B,E
580   150   FORMAT(' ',T09,F6.0,T30,F6.0,T49,F6.0,T64,F6.0,T79,F6.0)
590         WRITE(6,220)
600   220   FORMAT(' ENTER 1 TO CONTINUE OR ANY OTHER NUMBER TO STOP')
610         READ(5,*)NS
620         IF(NS.EQ.1)GO TO 129
630         STOP
640         END
```

Fig. 1. Computer program statement listing (FORTRAN).

not having a programmable calculator with "power-off" program storage, using a computer enables a program to be saved from one run to the next.

In developing the program, use was made of the basic equations for calculating azimuth and distance cited earlier. These have been built upon to provide beam bearings for use at both the local and distant stations and to furnish the surface distance between the two locations in statute miles, kilometers, and nautical miles. The program provides prompting for keying in coordinates and can display beam bearing (azimuth) and distance information on both the terminal screen and on an external page printer.

FORTRAN Program Details

Fig. 1 shows a listing of the 64 FORTRAN statements making up the computer program. Statements 10-30 write the headings 'beam bearing' and 'distance' on both the terminal screen (6) and an output data set (2) for possible later printout. Statements 40-60 write the subheadings 'local-deg,' 'distant-deg,' 'stat mi,' 'naut mi,' and 'km' the same way as the previous write statements, but on the next line. The "T" format is used to tab the subheadings across the lines in the same manner as a typewriter tab mechanism. Statements 80-100 write a blank line (space 1 line). Statements 110-150 prompt the user to enter the latitude and label it PLAM2. Statement 150 reads from the keyboard (5) in a flexible format (*). Statements 160-170 write a blank line on the screen (space 1 line). Statements 180-220 prompt the user to enter the longitude from the keyboard and label it PL2. Statements 230-240 write a blank line on the screen. Statement 250 assigns the variable PIE the value of pi (3.14.....). Statements 260-270 convert both local and distant latitudes from decimal degrees to radians. Statement 280 assigns variable N the value 1 (to be used later in the program). Statements 290-300 convert both local and distant longitudes from decimal degrees to radians. Statement 310 will be used to branch back to that point in the program from a later statement in the program. Statements 320-330 compute the beam bearing from one location to another. Statements 340-350 ensure that the beam bearing chosen is the shorter of the two possible (.LE. stands for "Less than or Equal to"). Statement 360 branches around statements 370-470 if N=2. Statements 370-470 reverse local and distant longitudes and latitudes, assign the variable Y to the previously computed beam bearing, set N=2, and branch back to statement 310 to compute beam bearing from the distant to the local QTH. Statement 480 is branched to from statement 360 if N=2 (both bearings

have been computed). Statements 490-520 compute the distance between the two locations. ABS (absolute value) strips off any negative sign and '.GT.' stands for "Greater Than." Statements 530-550 convert the distance to statute miles, nautical miles, and kilometers. Statements 560-580 write the answers under the appropriate subheadings on both the terminal and the output data set (for later printout). Format F6.0 means the number is printed in 6 spaces with no decimal places. Statements 590-610 prompt the user in determining whether to compute again using a new set of inputs or end the run. Statements 630 and 640 terminate the computer run.

```
10    PRINT
20    PRINT
30    PRINT "ENTER LATITUDE (IN DECIMAL DEGREES)"
40    PRINT "SOUTH LATITUDES ARE ENTERED AS NEGATIVE NUMBERS"
50    PRINT "LATITUDE";
60    INPUT A2
70    PRINT
80    PRINT "ENTER LONGITUDE (IN DECIMAL DEGREES)"
90    PRINT "WEST LONGITUDES ARE ENTERED AS NEGATIVE NUMBERS"
100   PRINT "LONGITUDE";
110   INPUT L2
120   PRINT
130   P1 = 3.14159
140   A1 = 41.87*P1/180.
150   A2 = A2*P1/180.
160   N = 1
170   L1 = 87.63 * P1/180.
180   L2 = L2 * P1/180.
190   Q2 = TAN (A1) * COS (L2-L1) - TAN (A2)
200   Q1 = Cos A1*Q2/SIN (L2-L1)
210   X1 = 270 + ((180./P1) * ATN (Q1))
220   L9 = L2-L1
230   IF L9 <= 0. THEN 270
240   IF L9 <= P1 THEN 260
250   GO TO 270
260   X1 = X1 - 180.
270   IF N = 2 THEN 390
280   L3 = L2
290   L4 = L1
300   L2 = L4
310   L1 = L3
320   A3 = A2
330   A4 = A1
340   A2 = A4
350   A1 = A3
360   Y1 = X1
370   N = 2
380   GO TO 190
390   C1 = ABS (L9)
400   IF C1 > P1 THEN 420
410   GO TO 440
420   C1 = 2.0 * P1 - C1
430   REM ARC COSINE MUST BE CONVERTED TO EQUIVALENT FORM IN BASIC
440   Z2 = SIN (A1) * SIN (A2)
450   Z3 = COS (A1) * COS (A2) * COS (C1)
460   Z4 = Z2 + Z3
470   Z1 = P1/2. - Z4 - Z4 ↑ 3/6 - Z4 ↑ 5*3./40. - Z4 ↑ 7 * 15./336.
480   Z1 = Z1 * 180./P1
490   A = 69.05 * Z1
500   B = 60.00 * Z1
510   E = 111.12 * Z1
520   PRINT
530   PRINT
540   PRINT "LOCAL-DEG", "DISTANT-DEG", "STAT MI", "NAUT MI", "KM"
550   PRINT
560   PRINT Y1, X1, A, B, E
570   PRINT
580   PRINT
590   PRINT "ENTER 1 TO CONTINUE OR ANY OTHER NUMBER TO STOP"
600   PRINT "CONTINUE";
610   INPUT N1
620   IF N1 = 1 THEN 10
630   END
```

Fig. 2. Computer program (BASIC).

BASIC Program Details

Fig. 2 shows a listing of the 63 BASIC statements used in rewriting the program in that language. Statements 10-60 prompt the user to enter distant latitude. Statements 70-110 do the same for distant longitude. Statements 120-210 perform the same function as FORTRAN statements 250-330. Statements 220-260 perform the same function as FORTRAN statements 340-350. Statements 270-390 are equivalent to FORTRAN statements 360-490. Statements 400-420 replace the IF statement on line 500 of the FORTRAN program. BASIC language does not contain an arc cosine (COS^{-1}) function. Therefore, the mathematical series giving a close approximation to this function has been substituted in statements 430-470. The series used is:

$$\cos^{-1} x = \frac{\pi}{2} - \left(x + \frac{x^3}{2 \cdot 3} + \frac{1 \cdot 3 x^5}{2 \cdot 4 \cdot 5} + \frac{3 \cdot 5 x^7}{2 \cdot 4 \cdot 6 \cdot 7} \cdots \right)$$

Statements 480-510 are equivalent to FORTRAN statements 520-550. Statements 520-580 print out the bearing and distance information. Statements 590-620 prompt the user in choosing between recomputation for another set of longitude and latitude and program termination.

Operation

After "signing-on" the time-sharing terminal, the program is called up for use and run. Immediately the headings and subheadings are displayed on the terminal screen. Then, the phrases "Enter latitude (in decimal degrees)" and "South latitudes are entered as negative numbers" appear on the screen. The desired distant latitude is then typed on the keyboard by the user. The same procedure is followed next to enter longitude. Computed values for beam bearing and distance then appear on the screen under the appropriate subheadings. At this point, the program will prompt the user with "Enter 1 to continue or any other number to stop." If a "1" is entered, the program will again prompt the user for new latitude and longitude values and will compute a new line of computed

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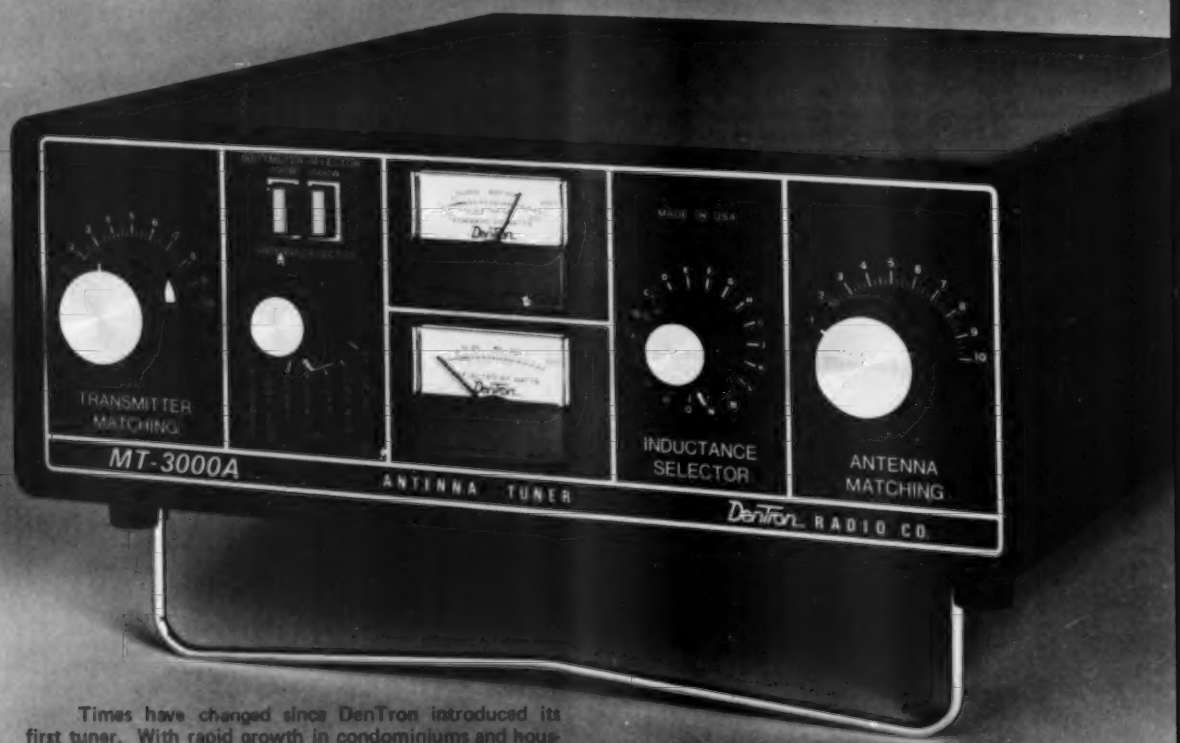

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Fig. 3. Printed copy of calculated data (Note: information contained within dotted lines does not appear on the printout).

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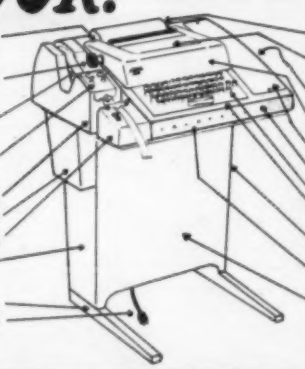

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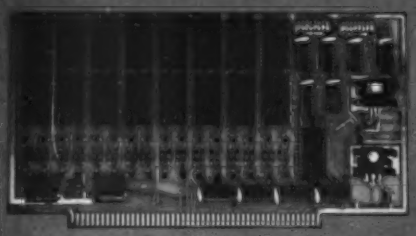

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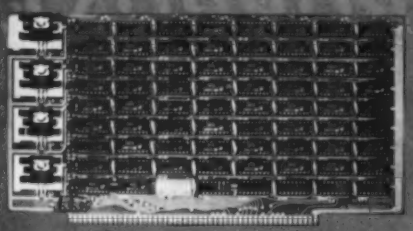

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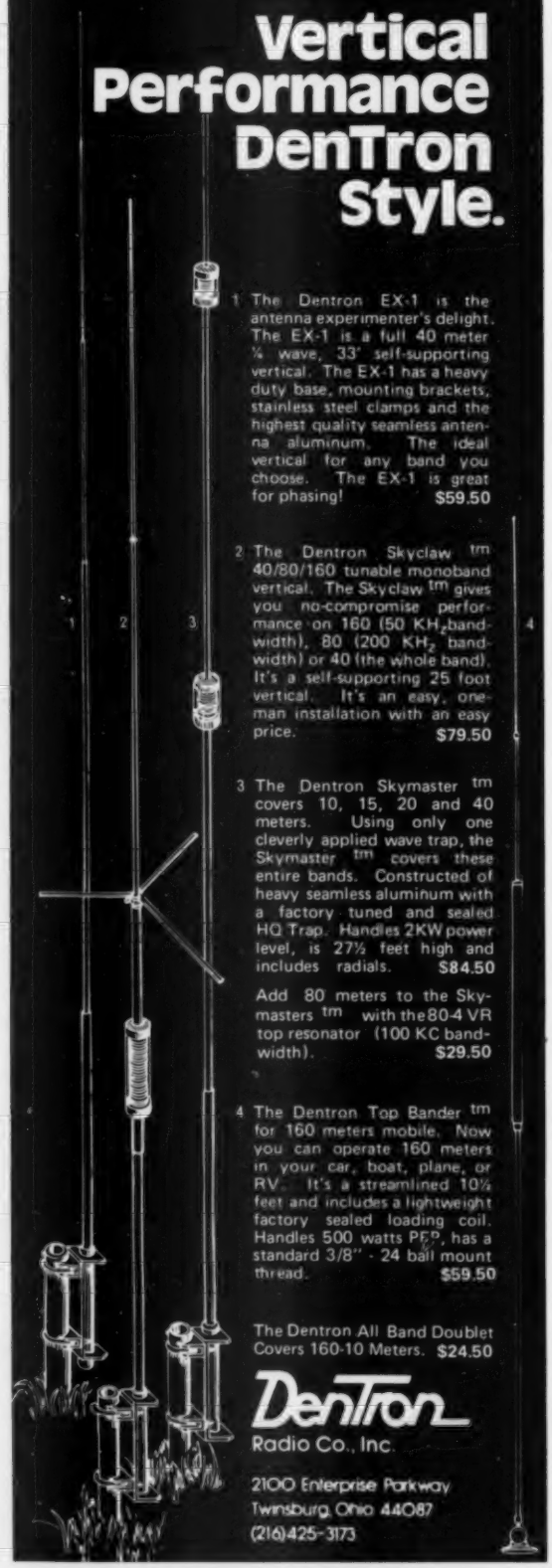

1 The Dentron EX-1 is the antenna experimenter's delight. The EX-1 is a full 40 meter ¼ wave, 33' self-supporting vertical. The EX-1 has a heavy duty base, mounting brackets, stainless steel clamps and the highest quality seamless antenna aluminum. The ideal vertical for any band you choose. The EX-1 is great for phasing! **$59.50**

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Regulated Nicad Charger

- - don't cook 'em!

More and more nicad cells are becoming available and many hams are utilizing them in portable rigs and test equipment. To avoid damaging these batteries though, a few precautions are necessary:

1. Always utilize the full capacity of the cell. Nicads have a sort of "memory" action and a unit that is habitually required to provide only ½ of its rated capacity will go dead at that half way level when the whole bit is needed.

2. Don't reverse charge a nicad. Keep the charge condition on all cells in a series string at the same percentage rate. Substitution of a partially charged cell into a series string of fully charged units may ruin the weaker cell through reverse charging.

3. When charging standard nicads (other than "Quick-Charge" units), limit the charge current to about 1/10 the rated Ampere-hour capacity. Excessive charge current causes overheating, which may result in seal rupture and venting of excess pressure. Once the seal is broken, the cell will rapidly dry out and become useless.

Item 3 above leads right into the reason for this article. Fig. 1 is representative of a "universal" type nicad charger circuit.

The transformer, rectifier, and filter capacitor are conventional design. The transformer itself is an 18 volt doorbell unit which gives a rectified dc output of 25 volts.

The current regulator is somewhat less conventional, as most hams are familiar with the emitter follower circuit in Fig. 2. Placing the load in the collector circuit as in Fig. 1 allows a measure of gain and results in better current limiting action.

In Fig. 1, resistor R1 is used to provide forward bias to the base of Q1, bringing that transistor into conduction. With no collector load (batteries) in the circuit, the emitter current is very low. Thus the resulting voltage drop across the base-emitter junction and R2 is not adequate to forward bias the two diodes, D1 and D2. This leaves the transistor in a full-on state with the whole supply voltage present at the output terminals.

Now, if we put a heavy load (0 Ohms) across the output terminals, the current will increase(!), but how much? Watch what happens. As the current increases, the voltage drop across R2 also increases. When the base-emitter drop plus the R2 drop reaches approximately 1.2 volts, the two diodes go into conduction and limit any further increase in base potential. Thus the current is limited to that point where the emitter circuit voltage drops equal the series turn-on potential of D1 and D2.

For silicon diodes, the turn-on potential is about 0.6 volts. This also holds true for the base-emitter junction of silicon transistors. This means that the required value for R2 is about 0.6 volts divided by the current limit desired.

Varying the load (using 1 to 18 nicad cells) reveals that the current limiting action will hold within 1 to 2 mA from 0 to 24 volts. In other words, you can charge any random number of cells from 1 to 18 without adjusting the charger.

Transistor Q1 should be chosen for a reasonably good hfe and a power capability of twice the total supply voltage times the current limit value. Since my primary interest is in 450 mAh penlight cells, my charge current is set at 45 mA. This means that my transistor must dissipate 25 volts times 0.045 Amperes, or 1.125 Watts. Double that for safety and a 2 Watt transistor is about right. ■

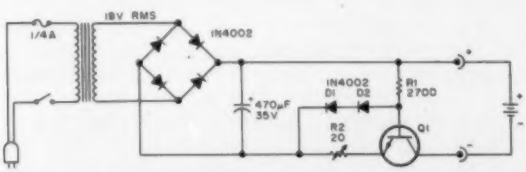


Fig. 1.

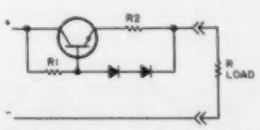


Fig. 2.

Complete

Repeater Control System

-- all that's missing is the computer

E. E. Buffington W4VGZ
2736 Woodbury Drive
Burlington NC 27215

You can build a repeater that will perform better than many commercial units. You can do it with six small plug-in circuit boards, a transmitter, and a receiver. Three of these boards were described in *73* recently in connection with autopatch. The circuits described in this article are made to interface with the autopatch boards.

CW Identifier

The K2OAW identifier is repackaged into a 22 pin plug-in 4 x 6 inch board. This circuit was presented in the February, 1973 issue of *73 Magazine* in an article by Pete Stark. I did add an audio oscillator for feeding the audio board described in *73*, April, 1977. The circuit master, schematic, parts layout, and parts list are provided for you to duplicate Pete Stark's excellent design in a more convenient layout.

Timer Board

The timer board has the four second tail timer, the three minute timeout or "windbag" timer, and the five minute ID timer.

Request for transmitter on can originate from a signal being received (COS), local microphone (PTT), autopatch (AP), and the CW identifier board (ID HOLD). The shutdown control (TRANSMITTER ENABLED) is also an input. The four second and three minute timers are resettable by the action of the 2N3906 transistor which, upon being triggered, partially discharges the timing capacitor. This reset does not result in four more seconds or three more minutes, as only about half the delay can be reset out.

The ID timer and logic will start the identifier initially with COS, PTT, or AP going low, and will identify five minutes later. It is possible for two IDs to take place one after another if the five minute timer runs down and just afterwards COS goes low. I am working on a new logic scheme that will result in less extraneous IDs. I will try to lay it out so that it will plug in the same socket so that no wiring changes to the socket are necessary.

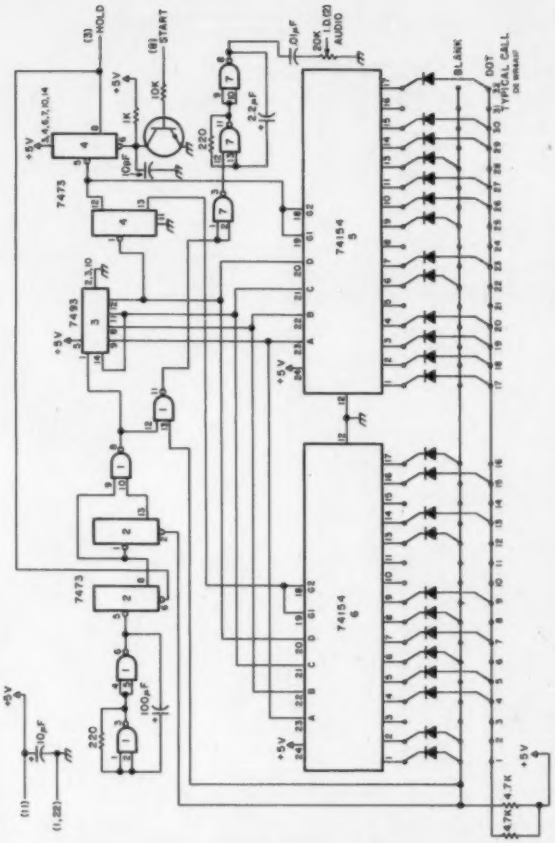


Fig. 1. K2OAW CW identifier.

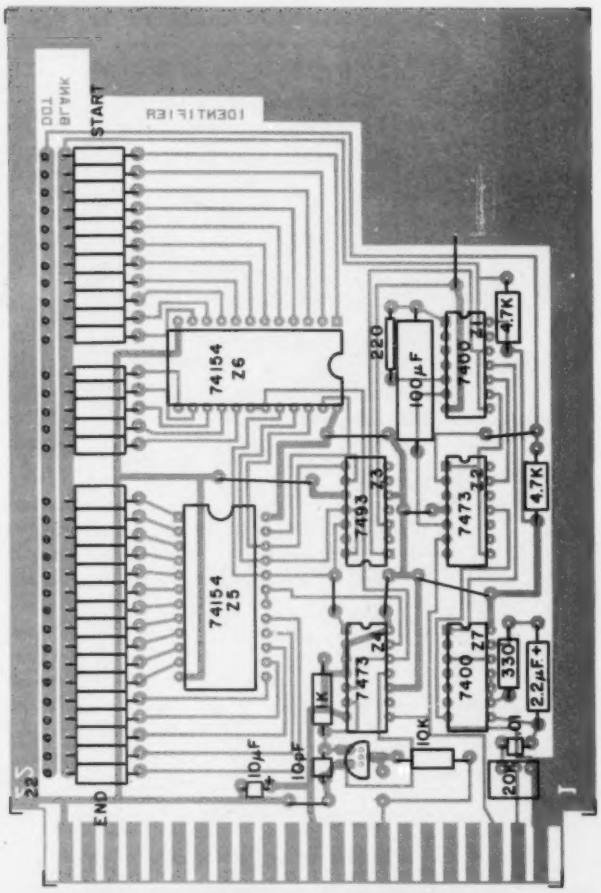
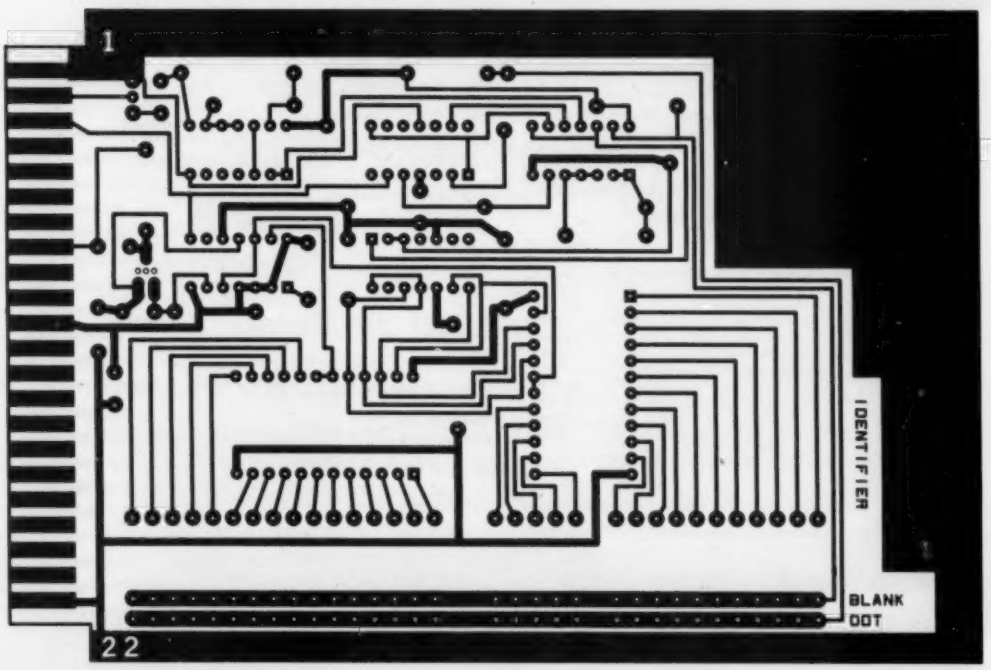


Fig. 2(b). Identifier component layout.

Fig. 2(a). Identifier board.



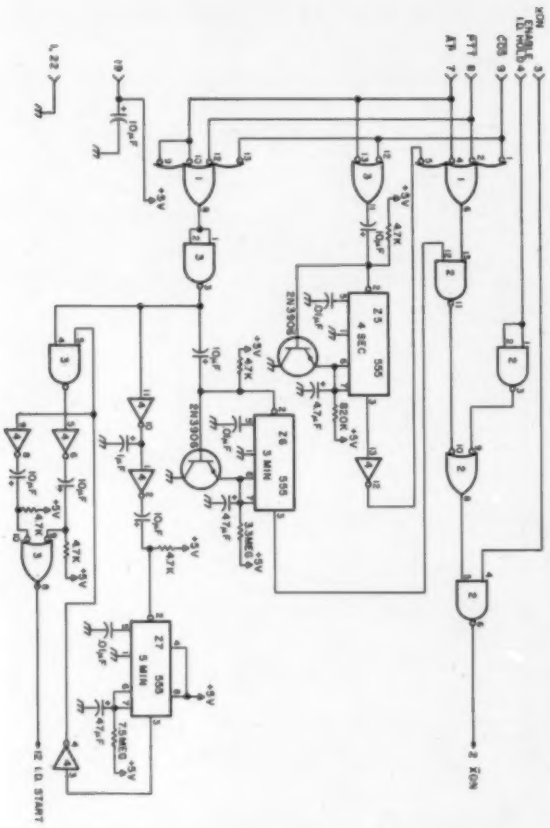


Fig. 3. Timer and control circuit schematic. Z1 – 7420; Z2, Z3 – 7400; Z4 – 7404; Z5, Z6, Z7 – 555.

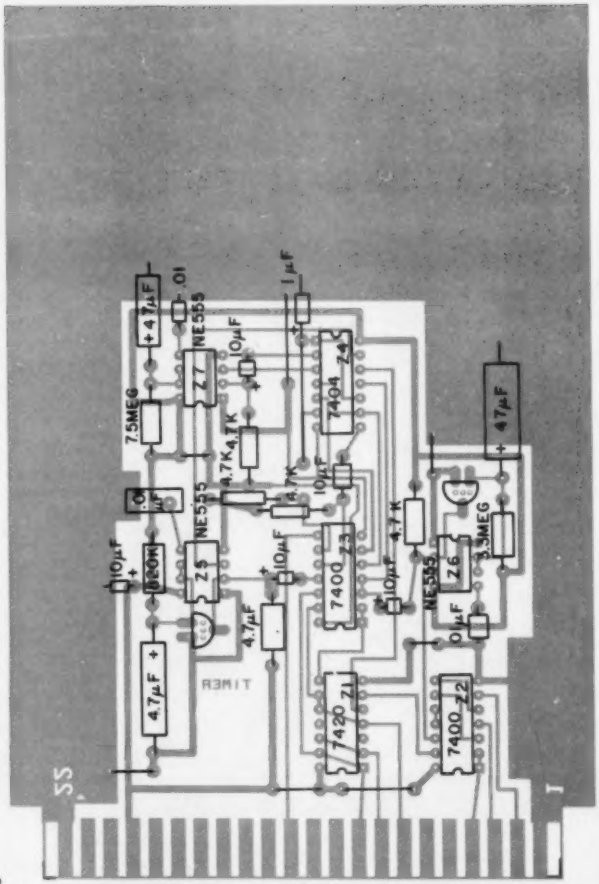
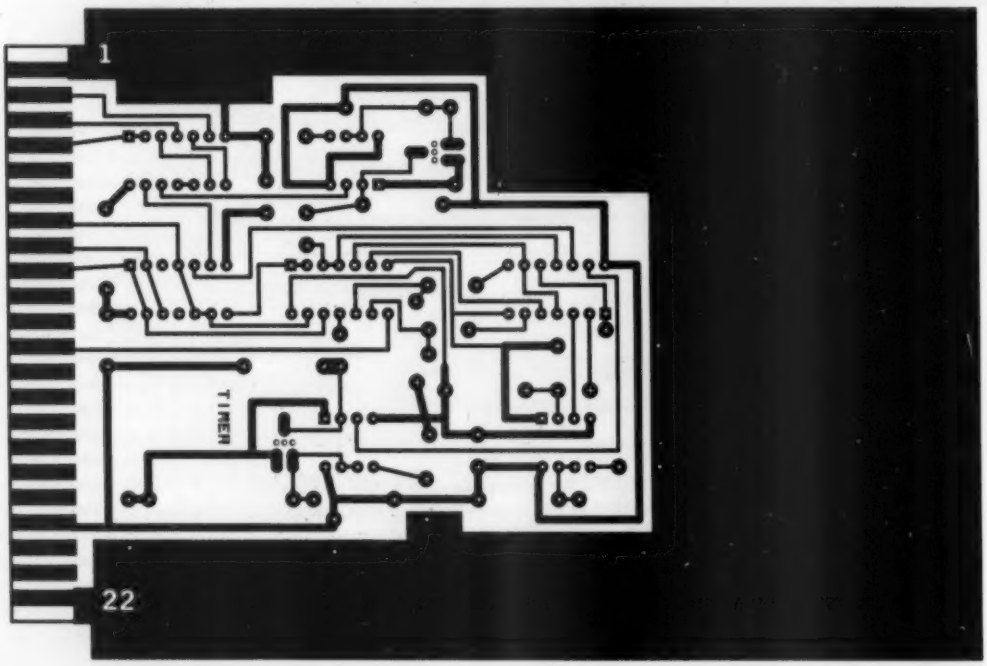


Fig. 4(b). Timer and control component layout.

Fig. 4(a). Timer and control board.



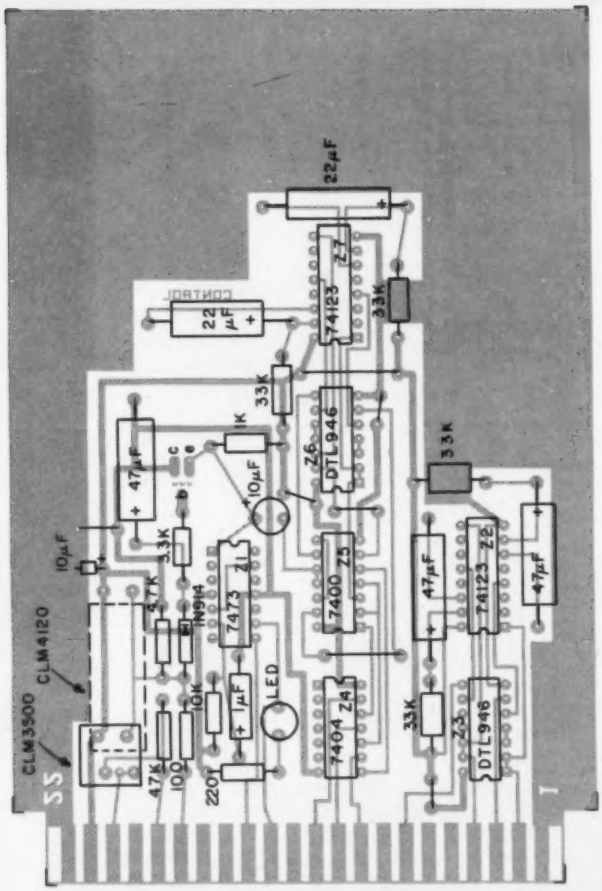


Fig. 6(b). Transmitter control component layout.

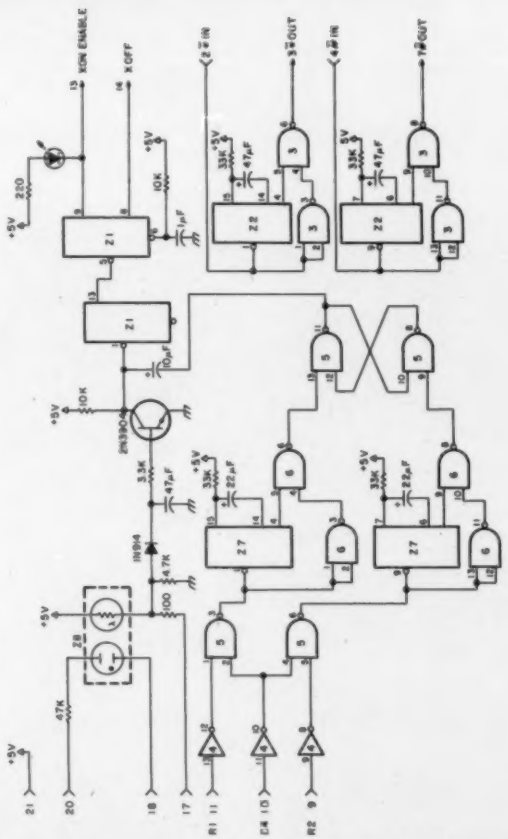
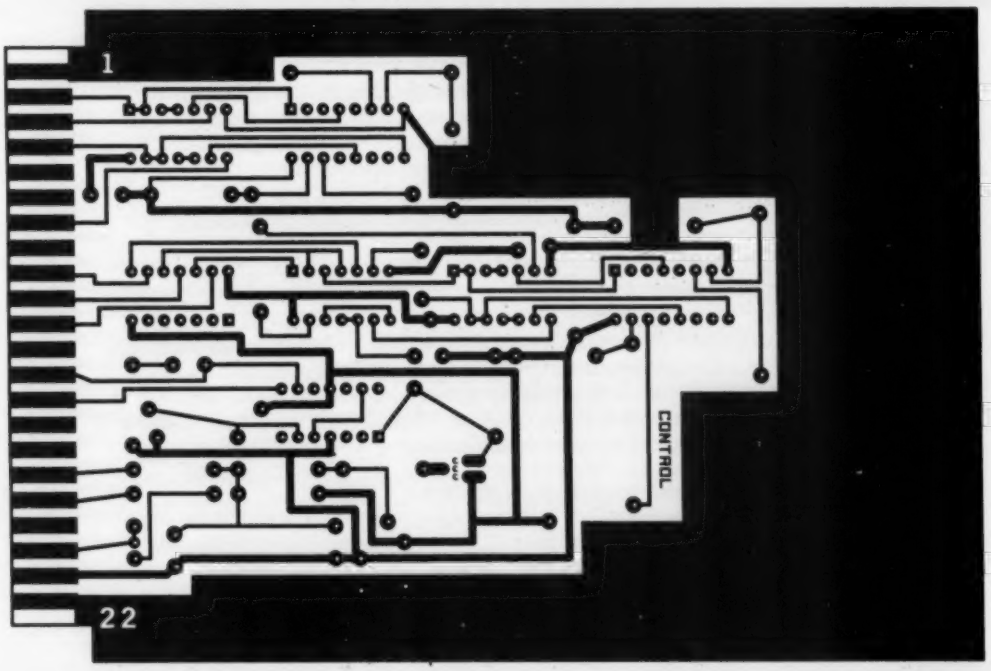


Fig. 5. Transmitter control. Z1 — 7473; Z2 — 74123; Z3 — DTL-946; Z4 — 7404; Z5 — 7400; Z6 — DTL-946; Z7 — 74123; Z8 — CLM 3500 or CLM 4120.

Fig. 6(a). Transmitter control board.



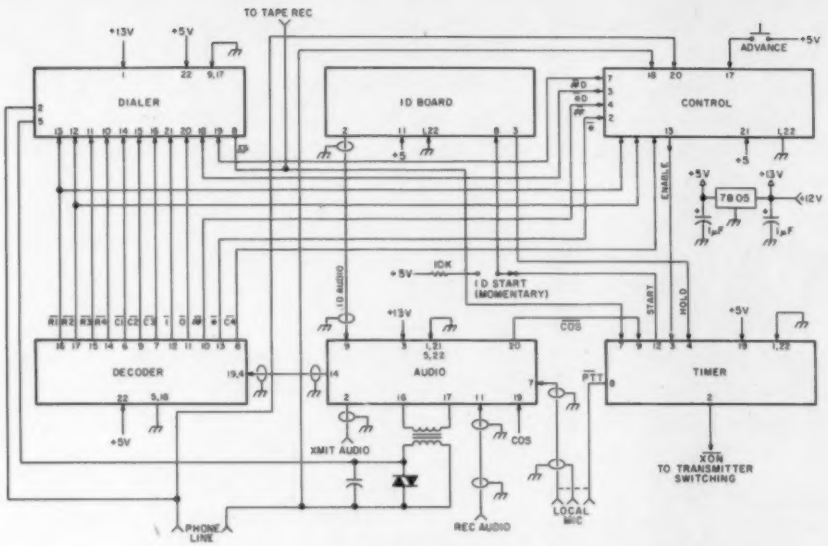


Fig. 7. Overall schematic.

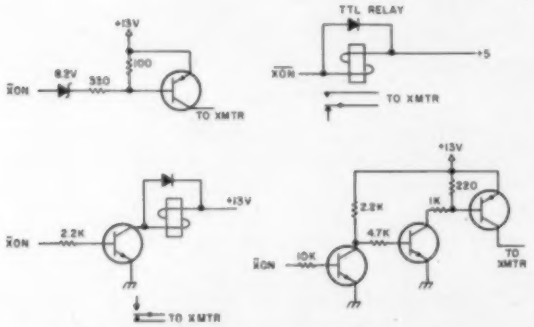


Fig. 8. Suggested transmit switching circuits.

Repeater Shutdown Board

This circuit is a must for remote controlled repeaters. This one will count the rings on the phone line and shut the repeater off by the "transmitter on enable" line going low. As a convenience and backup feature, touch-tone in the fourth column can also be used to turn off or on the machine. The (A) and (B) buttons of the 16 button pad are pressed alternately to do this. The 74123 (a retriggerable multivibrator, Z7) is used as a half-second debouncer. In the article (April, 1977) on autopatch, I included the schematic for a (*) and (#) one-second debounce circuit. This circuitry is included on this board. The neon optoisolator only draws 2 mA from the phone line during ringing. A means for manually advancing the counter using a push-button is shown on the overall schematic. The 10k Ohm resistor and the 1 uF capacitor connected to pin 6 of Z1 insure that after a power failure the circuit will come on with the transmitter enabled.

The Extender

A circuit master is included for an extender card. This card is soldered to a 22 pin connector. If you mount your circuit boards so that both sides are accessible for adjustment or test, then you will not need this aid (your boards will take up a lot of space though).

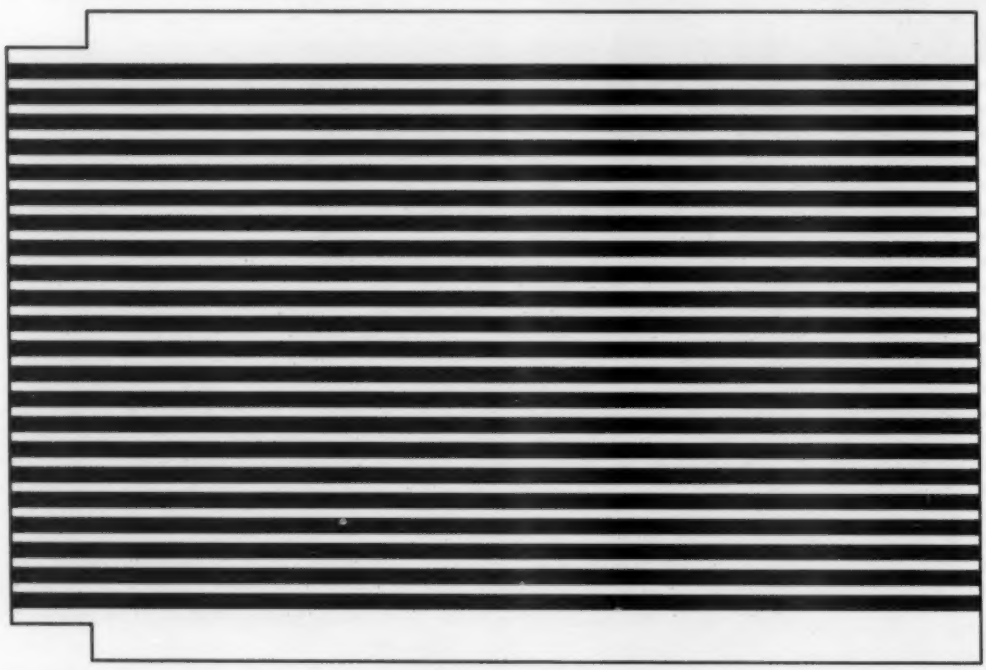


Fig. 9. Extender board.

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Interfacing

The six boards will require very little to interface with a receiver and transmitter. An active high of three volts or so is needed from the receiver as a carrier operated switch (COS) signal. The receiver audio input to the audio board can come directly from the discriminator over a shielded wire. The 470k Ohm resistor on the audio board is large enough so that loading of the discriminator should not be a problem. A few circuits are given as suggestions for turning on the transmitter. You can, I am sure, think of a better one to fit your individual transmitter. A similar circuit can be used for the (AP) signal turning on the tape recorder.

If you use all six of these boards, you should remove the MC7805CP from the dialer board and mount the regulator on a good heat sink, as the five volt load will be near an Amp and the MC7805CP does not have enough heat sink mounted to the dialer circuit board.

K2OAW Identifier

Quantity	Description
2	220 Ohm ¼ W
1	1k Ohm ¼ W
2	4.7k Ohm ¼ W
1	10k Ohm ¼ W
1	100 uF 10 volts
1	2.2 uF 10 volts
1	.01 uF disc ceramic
1	10 uF dipped tantalum
(unk.)	Program diodes as required
2	7473
1	7493
2	7400
2	74154
1	20k pot, Bourns 3389W

Timer and Control

5	4.7k Ohm ¼ W
1	820k Ohm ¼ W
1	3.3 megohm ¼ W
1	7.5 megohm ¼ W
2	47 uF 10 V tantalum
6	10 uF 10 V dipped tantalum
1	4.7 uF 10 V tantalum
1	1 uF 10 V tantalum
3	.01 uF disc ceramic
1	7420
2	7400
1	7404
3	555

Transmitter Control

1	100 Ohm ¼ W
1	47k Ohm ¼ W
1	4.7k Ohm ¼ W
1	3.3k Ohm ¼ W
2	10k Ohm ¼ W
4	33k Ohm ¼ W
1	220 Ohm ¼ W
1	LED
1	1N914 diode
1	2N3904
3	47 uF 10 V tantalum
2	22 uF 10 V tantalum
1	1 uF 10 V tantalum
1	7473
2	74123
2	DTL 946
1	7404
2	7400
1	Optoisolator CLM 3500 or CLM 4120, Clairex Electronics, 560 South Third Ave., Mt. Vernon NY 10550, (914) 664-6602

Fig. 10. Parts list. Circuit boards and parts can be obtained from: Stafford Electronics, 427 South Benbow Rd., Greensboro NC 27401, (919) 274-9917.

Parting Shots

So good luck with your repeater project and please let me know about it. A QSL card with "it works" would be OK. If you have trouble getting any of the parts, send an SASE and I will try to help you find a source. Try the ads in *73* first because that is where I get most of the parts I use. In a project this large, errors are bound to creep in. Let me or the editor know about it and corrections can be made. ■

Transmission Line Primer

-- in case you don't know everything

J. A. Murphy
3431 Oakdale, Apt. #2102
San Antonio TX 78229

A number of articles have appeared in the amateur literature in the past few years attempting to "explain," or perhaps "explain away," the concept of reflected power on transmission lines. The conclusions reached by some of the authors range from "It doesn't seem to make any difference, so why worry about it?" to "I can't understand it, so it must not exist!" But of course reflected power does exist; part of the signal arriving at a point of mismatch on a transmission line is reflected back down the line just as surely as part of a radio signal striking the moon, or part of a radar signal striking an airplane, is reflected back the way it came. So the problem is in understanding how a transmission line operates. What seems to be needed is a new (to the amateur fraternity at least) way of looking at the problem.

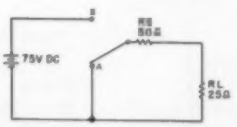

Fig. 1.

In the field of high speed digital logic, the characteristics of transmission lines and the effects of reflections on these lines is far more critical than in most radio communications systems. Luckily, the operation of a line driven with step functions or narrow pulses is also much easier to analyze than that of a line driven with constantly varying signals such as sine waves. Let's look into a very simple "digital" circuit consisting of a battery, a couple of resistors, and a chunk of cable. The analysis requires only the simplest of algebra and will provide tremendous insight into the whole subject.

First let's consider the trivial circuit in Fig. 1. When the switch is moved from contact A to contact B, a current of 1 Amp flows through the battery and both resistors, dropping 50 volts across RS and 25 volts across RL. Simple enough. Now let's move on to the circuit in Fig. 2, in which a long piece of cable, or transmission line, has been added. Now if we ignore the small resistance of the cable, we might expect this circuit to behave exactly like the first one. But it doesn't, not exactly! Remember that signals propagate along a transmission line at a finite speed; granted, it is a very high speed, usually greater than half the speed of light, but still a finite speed. This speed is specified by the line's velocity factor, which gives the speed of signal propagation on the line as a fraction of the speed of light. For most of the lines used by amateurs, this factor is about 0.66. That means signals propagate along the line at 0.66 times the speed of light, or about 0.66 feet per nanosecond. Then if our line in Fig. 2 is 660 feet long, it will take a signal 1000 ns, or 1 us, to get from one end to the other.

When the switch in Fig. 2 is thrown, current starts to flow through the battery, RS, and the end of the line. But it doesn't make it to the far end of the line, and RL, for 1000 ns. The obvious question at this point is "*How much* current flows during that 1000 ns?" Since there is no current at the far end of the line or in RL, then the value of RL can have no effect on the current. The only things controlling the current are the battery voltage, the value of RS, and the parameters of the line. The pertinent line parameter here is its characteristic impedance, or surge impedance. You've probably seen this defined as the impedance that would be seen looking into the end of an infinitely long line. It is equivalent, and perhaps easier to grasp, to say it is the impedance seen at the driven end of a cable before the signal has had time to reach the other end. And from that it follows that the line's characteristic, or surge, impedance (call it Z0), is the impedance seen by any signal moving along the line, that is, any wave propagating along a line always has its voltage equal to its current times Z0. Actually we've put the cart before the horse; the last statement is more nearly the textbook definition of Z0, and the previous two statements follow from it!

So if Z0 for the cable in Fig. 2 is 50 Ohms, the current through RS right after the switch is thrown is .75 Amps and the voltage across the near end of the line is 37.5 volts. If we look at the line 500 ns later, we find 37.5 volts across it at all points from the near end up to the middle and 0 volts at all points from the middle to the far end. Similarly we find .75 Amps flowing in the line at all points up to the middle and no current beyond. We are observing a signal, or wave front, or step, of 37.5 volts and .75 Amps propagating along the line at the rate of 0.66 feet per nanosecond.

Now let's consider what happens after 1000 ns, when the step reaches the far end of the line and RL. The ratio of voltage to current on the line is 37.5/.75=50, the line impedance. The ratio of voltage to current at RL must be the value of RL, or 25. So either the voltage, the current, or both must change. (Note that if RL were equal to Z0, no change would be necessary, steady state conditions would be reached in 1000 ns, and the only effect of the cable would be a time delay.) If either the voltage or the current at the far end of the line changes, this change won't be seen at the near end for another 1000 ns, during

which time the change propagates back along the line. This change traveling back along the line is called a reflection! But, as we have seen, any signal propagating along a line must have its voltage and current related by Z0. Thus the ratio of the change in voltage to the change in current caused by RL must be related by Z0. If we now designate the voltage and current moving from the near end toward the far end with a + superscript and those moving in the opposite direction with a - superscript, we can write three equations describing our findings:

$$(1)\quad E^+/I^+=Z0$$

$$(2)\quad E^-/-I^-=Z0$$

$$(3)\quad (E^++E^-)/(I^++I^-)=RL$$

Equation 1 says that the forward voltage and current are related by Z0. Equation 2 says that the reflected voltage and current are similarly related, but with an added - sign since the direction of propagation is reversed. Equation 3 simply says that the total voltage and current at the far end of the line, the sum of the forward and reflected waves, must be related by RL. The solution of these three equations for E^- and I^- yields:

$$(4)\quad E^-=(RL-Z0)/(RL+Z0)\cdot E^+$$

$$(5)\quad I^-=(Z0-RL)/(Z0+RL)\cdot I^+$$

Substituting the values from our example gives -12.5 volts for E^- and .25 Amps for I^-. Summing the forward and reflected components gives 25 volts and 1.0 Amp at RL.

Now let's follow the reflection back along the cable toward RS. If we look at the line 1750 ns after the switch was thrown, 750 ns after the reflection started, we will still find 37.5 volts and .75 Amps at all points in the first quarter of the line, but we'll see 25 volts and 1.0 Amp at all points in the last three quarters of the line. Remember that this 25 volts and 1.0 Amp are actually the sum of a forward wave (37.5 volts and .75 Amps) and a reflected wave (-12.5 volts and .25 Amps). We are watching a reflected wave propagate back to the near end of the line. After 2000 ns, the reflection reaches RS, where it sees a perfect match. Therefore, no changes in voltage or current are caused and no additional reflections are created. The reflected -12.5 volts combines with the 37.5 volts already present at the near end of the line to give 25 volts, the reflected .25 Amps combines with the .75 Amps already flowing giving 1.0 Amp, and steady state conditions are reached. Now the voltages and currents at the resistors are just like they were in Fig. 1. The steady state conditions of the two circuits are identical. The presence of the transmission line caused a transient condition, 2 us long in this case, to occur before steady state conditions were reached.

If we consider the battery and RS to be a transmitter and RL to be a load, in both Fig. 1 and Fig. 2 the transmitter delivers 25 Watts to the load once steady state conditions are reached. But in Fig. 2 the transmitter delivered 28.125 Watts to the line for 2 us. You might say the transmitter "thought" the load was 50 Ohms, the line impedance, and delivered power accordingly, until the reflected 3.125 Watt reflection got back and "told" it different.

So reflected power does exist. It's real, honest to goodness power, voltage in phase with current, capable of producing heat, doing work, or fitting whatever definition of power you care to use. And the job it does is "telling" the transmitter what's out there at the end of the line and forcing it to "adjust" its output accordingly. And if you're still worried about that "extra" power, consider what happens when you throw the switch back the other way. Again there is a 2 us transient condition. We continue to see 25 volts and 1.0 Amp (25 Watts) at RL for 1 us after the transmitter is turned off. And at the near end of the line we see -12.5 volts and .25 Amps (3.125 Watts) coming out of the line and being dissipated in the transmitter for 2 us! The "extra" power that we put into the line for 2 us when we turned the transmitter on came back out of the line for 2 us when we turned it off.

The circuit in Fig. 2 is just about the simplest possible case of line reflections. Now let's look at some of the reasons for its simplicity and see how things might get more complicated. Notice that we let the output impedance of our transmitter, RS, match the line impedance, Z0. This condition rarely exists in the real world! The widespread, and incorrect, use of the term "output impedance" to refer to recommended load impedance has led many people to believe that a transmitter designed to drive a 50 Ohm load has a 50 Ohm output impedance. While this is not impossible, it is highly unlikely. It takes a lot of extra work to make an amplifier of any kind, rf, audio, or anything else, have an output impedance anywhere near its recommended load impedance, and there is usually no reason whatsoever to try to do so. Except in very special applications, it would never even occur to the designer to think of such a thing! Therefore the reflected power will generally see a very large "mismatch" when it gets back to the transmitter and a considerable portion of it will be re-reflected. This means that, even in the simple dc circuits we've been looking at, the reflections, and the transient condition, will continue forever and the steady state conditions will never be reached but will be approached asymptotically by a series of discrete changes, or steps. This should not be too surprising, as it is very similar to charging a capacitor with a battery and resistor; the voltage on the capacitor never reaches the battery voltage, but approaches it asymptotically.

We also assumed we were dealing with a lossless line, a very difficult thing to come by! With any real line, part of the forward power is lost before it reaches the far end of the line, resulting in less power in the load and less reflected power. Similarly, part of the reflected power is lost before it gets back to the transmitter. This means that we've lost some of the information that "tells" the transmitter about the value of RL. Instead of "realizing" that the load is not Z0, but RL, the transmitter "thinks" that the load is something between Z0 and RL. This results in a little additional loss.

We also assumed the line was distortionless, or that it treated all frequencies in exactly the same way. This is another condition that is rarely even approximated in practice. The effect is to "round off" the nice square pulse we started with. Again this has no effect of the basics of reflections.

We have dealt only with impedances that were pure resistances, but while this greatly simplifies the math, it has no effect on the conclusions.

And finally we have only considered dc, or square pulse, conditions. But one of the basic principles of electronics tells us that if we know how a circuit responds to very narrow pulses, we can predict how it will respond to any other waveshape. We can create any arbitrary wave-

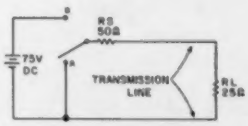

Fig. 2.

form by adding together a great number of narrow pulses and find the response by adding the responses to each of the pulses. When we consider sine waves, we must think of time delay in terms of phase shift and take into consideration the standing waves produced by the addition of the sine waves moving in opposite directions on the line. Things rapidly become much more complicated, but the basics remain unchanged: Any signal moving along a line does so with its voltage and current related by Z0; points of mismatch on the line cause reflections.

Please note that we've said nothing about the importance, or lack thereof, of reflections on overall system performance; that is not the purpose of this article. In a digital system, where the transmission line may be a couple of feet of hookup wire, or a few inches of copper on a PC card, reflections may be intolerable. In a relatively narrow band radio communications system, if the transmitter can operate into the load presented by the line, and the extra loss caused by reflections is tolerable, and the higher peak voltage caused by the standing waves doesn't break down the line, you can probably forget all about reflected power. The point is that reflections do exist, they are not a figment of some mathematician's imagination, and they don't violate any laws of nature!

So the next time you hear somebody claim that reflected power doesn't exist, or that the voltage and current in a reflected wave are always 90° out of phase, or that directional wattmeters can't be built, or any of the other absurd statements that are so often tossed about, sit down and draw a little circuit similar to Fig. 2 and think about it for a few minutes. All those stupid engineers are right after all! ■

Things Remembered

-- ever heard of an 807?

Daniel T. Davis W8LUX
1610 E. McKinley
South Bend IN 46617

I've never really been too certain about what it takes to be called an old-timer – being licensed for 50 years, holding a two letter call, or perhaps having had your start with a spark gap transmitter. Whatever the specific element happens to be, memories have to play an important role, and this is an area where I'm making progress towards that "OT" designation.

After having been exposed to amateur radio for a quarter of a century and an actual participant in it for the past 20 years, I've begun to notice that a lot of things I once took for granted just aren't around any more.

Recently I put together a partial list of some of the things associated with amateur radio which were once important to me. Check it over and see if there's anything you recognize:

– Crystals for 80 and 40 meters that came in those rugged FT-243 holders.
– Those strange WV calls which were assigned to Novices briefly in the late 1950s.
– The thrill of using a VFO for the first time to explore the area below 3700 kHz.
– When you said "kilocycle" and everyone knew what you meant.
– A CW signal that was actually produced by a human being and not a device, mechanical or electronic.
– Blazing arguments about whether sideband would ever compete with AM.
– Transmitters that had a DSB mode.
– Building those Johnson or WRL screen modulators as a means of getting on phone inexpensively.
– Discovering that the screen modulator really worked.
– The night I actually heard someone over six meters on my Hallicrafters S-53A.
– Catalogs from mail-order electronics supply houses that were 200 pages thick.
– When six or seven manufacturers published catalogs.
– All those surplus equipment stores near Arch Street in Philadelphia where a 110 V ac DPDT relay cost a buck.
– Row after row of ARC-5 equipment in those surplus stores.
– An 807 which didn't become gassy after 50 hours of use.
– The Viking Adventurer, Globe Chief 90, Heath AT-1, and all the similar transmitters that made it possible for a Novice with a schoolboy's allowance to get on the air.
– Hearing the FCC examiner tell you that someone in Washington would send you your General ticket in about four weeks.
– Finding out that the examiner and the man in Washington were men of integrity.
– When you didn't have to own a linear and make an appointment to QSO on 20 phone.
– Something called 2½ meters.
– Or even 11 meters.
– Fidgeting with the BFO to unscramble those "Donald Duck" voices.
– A handful of guys fooling around with commercial FM gear on six meters.
– When it was rare to see a K-call in the "Silent Keys" column of *QST*.
– Almost coming to blows with someone over incentive licensing.
– When postage for a QSL card only cost two cents.
– An *enfant terrible* publishing a new ham magazine that was irreverent, humorous, and simply interesting to read.
– The *enfant terrible* has mellowed somewhat, but thankfully his magazine hasn't.

No, I'm neither ready nor qualified to be called an old-timer. I really look forward to my next 25 years in ham radio, but in my "middle age" I can't help but look back and, like the well-known comedian, simply say, "Thanks for the memories." ■

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7432	.30	74141	.71
7437	.35	74145	.97
7438	.35	74151	.71
7440	.17	74153	.81
7442	.60	74154	.97
7443	.60	74161	.91
7444	.65	74163	1.05
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75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
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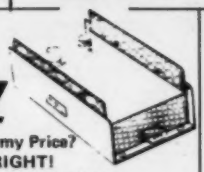

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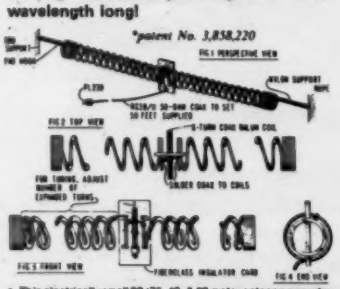
A LOT of antenna in a LITTLE space

New Slinky® dipole* with helical loading radiates a good signal at 1/10 wavelength long!



* This electrically small 80/75, 40, & 20 meter antenna operates at any length from 24 to 70 feet • no extra balun or transmatch needed • portable—erects & stores in minutes • small enough to fit in attic or apartment • full legal power • low SWR over complete 80/75, 40, & 20 meter bands • much lower atmospheric noise pickup than a vertical and needs no radials • kit includes a pair of specially-made 4-inch dia. by 4-inch long coils, containing 335 feet of radiating conductor, balun, 50 ft. RG58/U coax, PL259 connector, nylon rope & instruction manual • now in use by US Dept. of State, US Army, radio schools, plus thousands of hams the world over.

FT-101E TRANSCEIVER

YAESU

FT 301	160M-10M Transceiver – 200 WPEP	$769
FP 301 DIG	160M-10M Transceiver – 200 WPEP	935
FP 301	AC Power Supply	125
FP 301 CID	AC P.S. w/Clock and CW ID	209
FRG-7	General Cov. Synthesized Receiver	299
QTR-24	Yaesu World Clock	30
FT-101-E 160-10M	XCVR W/Processor	729
FT-101EE 160-10M	XCVR W/O Processor	649
FT-101EX 160-10M	XCVR W/O Processor AC Only, Less Mike	589
FL-2100B	Linear Amplifier	399
FTV-650B	6M Transverter	199
FTV-250	2M Transverter	199
FV-101B	External VFO	109
SP-101B	Speaker	22
SP-101PB	Speaker/Patch	59
YO-100	Monitor Scope	199
YD-844	Dynamic Base Mike	29
FA-9	Cooling Fan	15
MMB-1	Mobile Mount	19
RFP-102	RF Speech Processor	79
XF-30C	600 Hz CW Filter	40
FR-101S SOLID STATE	160-2M/SW RCVR	489
FR 101 DIG SOLID STATE	160-2M/SW RCVR	599
FT 301S	160-10M 40WPEP	559
FT 301S	160-10M 40WPEP Digital	765

Accessories:		
FC-6	6M Converter	24
FC-2	2M Converter	25
FM-1	FM Detector	20
	Aux/SW Crystals	5
XF-30B	AM-Wide Filter	40
XF-30C	600 Hz CW Filter	40
XF-30D	FM Filter	49
SP-101B	Speaker	22
FL-101 SOLID STATE TRANSMITTER	160-10M	525
Accessories:		
RFP-101	RF Speech Processor	79
MONITOR/TEST EQUIPMENT		
YC 500 J	500 MHz (10 PPM) Counter	249
YC 500 S	500 MHz (1 PPM) Counter	365
YC 500 E	500 MHz (0.02 PPM) Counter	489
YO-100	Monitor Scope	199
YP-150	Dummy Load/Watt Meter	69
YC-601	Digital Readout (101/401 series)	169
VHF FM & SSB TRANSCEIVERS		
FT-620B	6M AM/CW/SSB	365
FT-221	2M AM/FM/CW/SSB	629
Accessories:		
MMB-4	Mobile Mount (FT-620B, FT-221)	19

TUFTS

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209 Mystic Avenue
Medford MA 02155
(617) 395-8280

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Credit card #_____ Interbank #_____
Signature_____ Card expiration date_____

Cash orders over $1200 deduct 5%. No other discounts offered. All sales final.

MasterCharge American Express BankAmericard accepted on MOST items!

Prices FOB Medford MA. All units can be shipped UPS. MA residents add 5% sales tax. Minimum $3.00 for shipping & handling on all orders. $10.00 merchandise minimum please.

TUFTS RADIO CATALOG TUFTS RADIO

HAM RADIO / MOBILE COMMUNICATIONS

THOMSON-CSF
NPC
ELECTRONICS

MODEL	NET PRICE		
12V4	$19.95	*13 HM 4	$41.95
600	$20.50	104R	$49.95
102	$24.95	12/115	$69.95
612	$27.95	108R	$79.95
107	$28.95	108RM	$99.95
12 HM 4	$29.95	109R	$149.95

MODEL 12HM4

NPC 2.5 Amp Regulated Power Supply. Solid State. Short Circuit Protected.

Low cost regulated power supply quietly converts 115 volts AC to 13.5 volts DC ±200 millivolts. 1.5 amps continuous, 2.5 amps reg. Ideally suited for operating mobile CB transceivers in your home or office base station.

ALSO! Available as 13 HM 4 with built-in loudspeaker.

	TYPICAL	MAXIMUM
Output Voltage	13.5 ±.5VDC	14VDC
Continuous Current	1.5 Amp	
Regulation	2.5 Amp	
Ripple/Noise	5 mV RMS	10 mV RMS

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 107

NPC 4 Amp Power Supply, 6 Amp Max. Solid State. Overload Protected

Functions silently in converting 115 volts AC to 12 volts DC. 4 amps continuous, 6 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette player or car radio in a home or office.

Continuous Current (Full Load)	4 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	10,000 uF
Ripple (Full Load)	.5 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 5 lbs.

MODEL 103R

NPC 4 Amp Regulated Power Supply. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 2.5 amps continuous and 4 amps max. Ideally suited for applications where no hum and DC stability are important such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	2.5 Amp	
Current Limit	4 Amp	
Current Foldback	1 Amp	

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

MODEL 109R

NPC 25 Amp Regulated Power Supply. 4-Way Protected. Output Voltage and Current Meters.

Extra heavy-duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 10 amps continuous, 25 amps max. All solid state. Features dual current overload, overvoltage and thermal protection. Ideally suited for operating mobile Ham radio and linear amplifier in your home or office. Excellent bench power supply for testing and servicing of mobile communications equipment.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	50 mV	100 mV
Ripple Noise	5 mV RMS	10 mV RMS
Transient Response	20 uSec	
Current Continuous	10 Amp	
Current Limit	26 Amp	
Overvoltage Protection	14.5 V	15 V
Thermal Overload	180°F	

Case: 4¾" (H) x 9" (W) x 8½" (D). Shipping Weight: 15 lbs.

MODEL 12V4

NPC 1.75 Amp Power Supply. 3 Amp Max.

Functions silently in converting 115 volts AC to 12 volts DC. Ideally suited for most applications including 8-track stereo, burglar alarm, car radio and cassette tape player within power rating.

Continuous Current (Full Load)	1.75 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.4 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 108RM

NPC 12 Amp Regulated Power Supply. Solid State. 3-Way Protected. Current Meter.

This heavy duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 8 amps continuous, 12 amps max. All solid state. Features dual current overload and overvoltage protection. Ideally suited for operating mobile Ham radio 2 meter AM-FM-SSB transceivers in your home or office. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	8 Amp	
Current Limit	12 Amp	
Current Foldback	2.5 Amp	
Overvoltage Protection	14.5 V	15 V

Case: 4¾" (H) x 7½" (W) x 5½" (D). Shipping Weight: 9.5 lbs.

ALSO AVAILABLE AS MODEL 108RA WITHOUT METER AND OVERVOLTAGE PROTECTION.

MODEL 104R

NPC 6 Amp Power Supply Regulated. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 4 amps continuous and 6 amps max. Ideally suited for applications where excellent DC stability is important, such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can be used to trickle-charge 12 volt car batteries.

	MAXIMUM	TYPICAL
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	4 Amp	
Current Limit	6 Amp	
Current Foldback	2 Amp	

Case: 3½" (H) x 5½" (W) x 6½" (D). Shipping Weight: 6 lbs.

MODEL 102

NPC 2.5 Amp Power Supply. 4 Amp Max. Solid State. Overload Protected.

Functions silently in converting 115 volts AC to 12 volts DC. 2.5 amps continuous, 4 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette tape player or car radio in a home or office.

Continuous Current (Full Load)	2.5 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.6 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¾" (D). Shipping Weight: 4 lbs.

MARINE & RV

MODEL 12-115

NPC 12-115 Solid State Inverter. 200 W. Parallel Connection for Higher Power up to 360 W.

Converts 12 volts DC to 115 volts AC @ 60 Hz output. 200 watts continuous operation with peak power up to 240 watts. All silicon semiconductors assure high reliability at excessive ambient temperatures. The output voltage is a square wave. The inverter is not recommended where high transients are not tolerable.

The 12-115 allows you to have AC house current in your boat, car, truck, camper, house trailer, or houseboat. Will operate small household appliances, T.V., hand tools, electric shaver, AC radios, and lights within power rating. Built-in overload protection.

	12 VDC IN	14 VDC IN
Output Voltage (No Load)	115 V RMS	130 V RMS
Output Voltage (Full Load)	100 V RMS	115 V RMS
Frequency (No Load)	58 Hz	66 Hz
Frequency (Full Load)	54 Hz	62 Hz
Power Continuous	200W	
Power Peak	240W	
Parallel Connection	350W	

All Values Are Typical

Case: 4½" (H) x 7½" (W) x 5½" (D). Shipping Weight: 7 lbs.

MODEL 612

Model 612 Power Converter

NPC 612 converts 6 volt negative ground or 12 volt positive ground electrical systems to 12 volt negative ground operation. Provides full 3 amp continuous power. The inexpensive solution for installing car radios, stereo and cassette tape players, in vehicles with 6 volt negative ground or 12 volt positive ground systems.

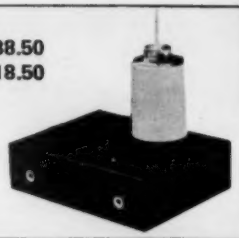
Case: 2¾" (H) x 3" (W) x 5" (D). Shipping Weight: 1 lb.

Larsen Antennas to fit Any Mobile Unit

Larsen Antennas

Magnetic Mount or Gutter Clamp 5/8 wave — $38.50
Specify, 2 meters, 220, 450. 1/4 wave — $18.50

3/8" single hole mount
5/8 wave — $31.50
1/4 wave — $11.50



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model 372 CLIPREAMP

Model 372 — $27.50

Get maximum legal modulation without danger of splatter. Solid-state speech preamplifier and clipper for transmitters, public-address systems, and tape recorders needs no external power.

• specifications

Input Impedance	100,000 ohms
Input Levels	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" x 3" x 4-1/2"
Shipping Weight	7 oz.
Connectors	Terminal strip

COAXIAL ANTENNA CHANGEOVER RELAY

model 377

Model 377 — $17.95

Economical and reliable. Can be operated from VOX circuit for completely automatic operation or from PTT or manual T/R switch. Receiver input is automatically grounded when the relay is in the Transmit position. Wide AC operating voltage range and low operating current.

• specifications

Power Rating	1000 watts CW (2000 watts SSB)
VSWR	Less than 1.15:1, DC to 150 MHz
Power Requirements	0.015 Ampere, 48 to 130 volts AC
Connectors	UHF Type SO-239
Dimensions	2-1/2" x 1-1/2"
Shipping Weight	1 lb.

UNIVERSAL HYBRID COUPLER II PHONE PATCH

model 300ZW and model 300IW

Model 300 2W with *Compreamp* — $125.00

Model 300 1W without *Compreamp* — $85.00

Connect your station to the telephone lines. Five switch-selectable modes give complete flexibility for patching the station to the line and for tape recording and playback to or from the line or the station. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in *Compreamp* speech preamplifier/limiter (in Model 300ZW) increases the level of weak phone signals and also prevents overmodulation when the local telephone is used as the station microphone. (The *Compreamp* also functions as a preamplifier/limiter with the station microphone, if desired.)

• specifications

Inputs from:	
Line	600 ohms
Receiver	4 ohms
Microphone	High impedance (50,000 ohms) crystal or dynamic
Tape Recorder	4 ohms
Outputs to:	
Transmitter	50,000 ohms
Receiver Speaker	4 ohms
Tape Recorder	0.8 megohm
Size	9-1/2" x 7-1/2" x 3"
Shipping Weight	3-1/2 lbs.
Power	9-volt battery, Burgess 2U6 or equivalent
Connectors	Phono

BARKER & WILLIAMSON, INC.

Model 359 — $37.50

Increase your transmitter's effective speech power up to four times. Or use it with your tape recorder or public address system for improved performance. This two-stage, transistorized Audio Preamplifier/Limiter can be used with all types of transmitters. Powered by a long-lasting dry-cell battery—no external power needed. Installs without any wiring changes in your transmitter. Just connect the *Compreamp* between your microphone (50,000-ohm dynamic or high-impedance ceramic) and your transmitter's microphone input connector. Front-panel rocker switch lets you bypass the *Compreamp* when you want to. Compression level is adjustable, too.

• specifications

Input Impedance	100,000 ohms
Input Level	5 millivolts to 20 millivolts
Voltage Gain	10 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	2-3/4" x 3" x 4-1/2"
Shipping Weight	9-1/2 oz.
Connectors	Terminal strip

COAXIAL SWITCHES AND ACCESSORIES

for antenna selection and RF switching

These high-quality switches have set the standard for the industry for years. Ceramic switches with silver-alloy contacts and silver-plated conductors give unmatched performance and reliability from audio frequencies to 150 MHz.

B&W coaxial switches are designed for use with 52- to 75-ohm non-reactive loads, and are power rated at 1000 watts AM, 2000 watts SSB. Connectors are UHF type. Insertion loss is negligible, and VSWR is less than 1.2:1 up to 150 MHz.

Crosstalk (measured at 30 MHz) is -45 dB between adjacent outlets and -60 dB between alternate outlets.

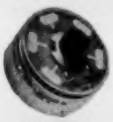
Models are available for desk, wall, or panel mounting, and with or without protective grounding of inactive outputs. Radial (side-mounted) connector models can be either wall or panel mounted; axial (backplate-mounted) connector models are for panel mounting only, save panel space.

Use the selector chart below to choose the models you need.

Model 550A

Model 551A

Model 590


Model 590G

Model 592

Model 595

COAXIAL SWITCH SELECTOR CHART

Model	PRICE	Outputs	Connector Placement	Mounting: Panel	Mounting: Wall	Mounting: Desk	Automatic Grounding	Dial Plate	Remarks
376	18.95	6	Axial	x			x	Supplied	PROTAX switch. Grounds all except selected output circuit.
378	18.95	5	Radial	x	x		x	Supplied	PROTAX switch. Grounds all except selected output circuit. Sixth switch position grounds *all* outputs.
550A	14.00	5	Radial	x	x			DP-5	
550A-2	12.50	2	Radial	x	x			DP-2	
551A	17.50	2	Radial	x	x			DP-2	Special 2-pole, 2-position switch used to switch any RF device in or out of series connection in a coaxial line. See figure (over).
556	.95	–	–		x			–	Bracket only, for wall mounting of radial connector switches.
590	17.95	5	Axial	x				DP-5	
590G	17.95	5	Axial	x			x	Supplied	Grounds all except selected output circuit.
592	16.50	2	Axial	x				DP-2	
595	18.50	6	In-line		x	x	x		Grounds all except selected output circuit.

Model 375

Model 376

Model 550A-2

There is no substitute for quality, performance, or the satisfaction of owning the very best.

Hence, the incomparable Hy-Gain 3750 Amateur transceiver. The 3750 covers all amateur bands 1.8-30 MHz (160-10 meters). It utilizes advanced Phase-Lock-Loop circuitry with dual gate MOS FET's at all critical RF amplifier and mixer stages. There's a rotating dial for easy band-scanning and an electronic frequency counter with digital readout and a memory display that remembers frequencies at the flip of a switch. And that's just the beginning.

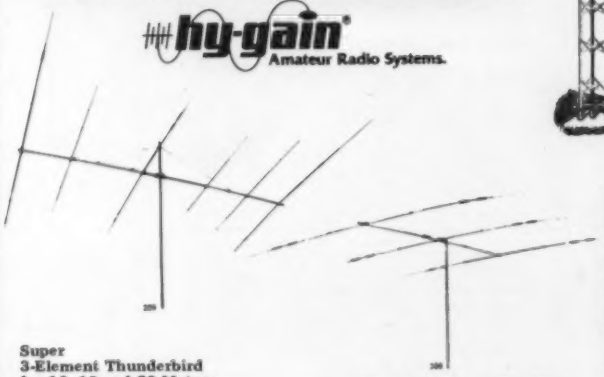
Matching speaker unit (3854) and complete external VFO (3855) also available.

See the incomparable Hy-Gain 3750 at your radio dealer or write Department MM. There is no substitute.

3854 – $89.95 3750 – $1895.00 3855 – $495.00

There is no substitute.

hy-gain Amateur Radio Systems.



Super 3-Element Thunderbird for 10, 15 and 20 Meters Model TH3Mk3 — $199.95

Hy-Gain's Super 3-element Thunderbird delivers outstanding performance on 10, 15 and 20 meters. The TH3Mk3 features separate and matched Hy-Q traps for each band, and feeds with 52 ohm coax. Hy-Gain Beta Match presents tapered impedance for most efficient 3 band matching, and provides DC ground to eliminate precipitation static. The TH3Mk3 delivers maximum F/B ratio, and SWR less than 1.5:1 at resonance on all bands. Its mechanically superior construction features taper swaged slotted tubing for easy adjustment and larger diameter. Comes equipped with heavy tiltable boom-to-mast clamp. Hy-Gain ferrite balun BN-86 is recommended for use with the TH3Mk3.

Electrical	TH6DXX	TH3Mk3
Gain—average	8.7dB	8dB
Front-to-back ratio	25dB	25dB
SWR (at resonance)	Less than 1.5:1	Less than 1.5:1
Impedance	50 ohms	50 ohms
Power rating	Max legal	Max legal
Mechanical		
Longest element	31.1'	27'
Boom length	24'	14'
Turning radius	20'	15.7'
Wind load at 80 MPH	156 lbs.	103.2 lbs.
Maximum wind survival	100 MPH	100 MPH
Net weight	57 lbs.	36 lbs.
Mast diameter accepted	1¼" to 2½"	1¼" to 2½"
Surface area	6.1 sq. ft.	4.03 sq. ft.

6-Element Super Thunderbird DX for 10, 15 and 20 Meters Model TH6DXX

$239.95 Separate Hy-Q traps, featuring large diameter coils that develop an exceptionally favorable L/C ratio and very high Q, provide peak performance on each band whether working phone or CW. Exclusive Hy-Gain beta match, factory pretuned, insures maximum gain and F/B ratio without compromise. The TH6DXX feeds with 52 ohm coaxial cable and delivers less than 1.5:1 SWR on all bands. Mechanically superior construction features taper swaged, slotted tubing for easy adjustment and re-adjustment, and for larger diameter and less wind loading. Full circumference compression clamps replace self-tapping sheet metal screws. Includes large diameter, heavy gauge aluminum boom, heavy cast aluminum boom-to-mast clamp, and heavy gauge machine formed element-to-boom brackets. Hy-Gain's ferrite balun BN-86 is recommended for use with the TH6DXX.

HY-GAIN'S INCOMPARABLE HY-TOWER FOR 80 THRU 10 METERS

Model 18HT
- **Outstanding Omni-Directional Performance**
- **Automatic Band Switching**
- **Installs on 4 sq. ft. of real estate**
- **Completely Self-Supporting**

By any standard of measurement, the Hy-Tower is unquestionably the finest multi-band vertical antenna system on the market today. Virtually indestructible, the Model 18HT features automatic band selection on 80 thru 10 meters through the use of a unique stub decoupling system which effectively isolates various sections of the antenna so that an electrical ¼ wavelength (or odd multiple of a ¼ wavelength) exists on all bands. Fed with 52 ohm coax, it takes maximum legal power ... delivers outstanding performance on all bands. With the addition of a base loading coil, it also delivers outstanding performance on 160 meters. Structurally, the Model 18HT is built to last a lifetime. Rugged hot-dipped galvanized 24 ft. tower requires no guyed supports. Top mast, which extends to a height of 50 Ft., is 6061ST6 tapers aluminum. All hardware is iridite treated to MIL specs. If you're looking for the epitome in vertical antenna systems, you'll want Hy-Tower. Shpg. Wt., 96.7 lbs. Order No. 182 Price: $259.95

NEW Special hinged base assembly on Model 18HT allows complete assembly of antenna at ground level ... permits easy raising and lowering of the antenna.

BROAD BAND DOUBLET BALUN for 10 thru 80 meters Model BN-86 $15.95

The model BN-86 balun provides optimum balance of power to both sides of any doublet and vastly improves the transfer of energy from feedline to antenna. Power capacity is 1 KW DC. Features weatherproof construction and built-in mounting brackets. $15.95 Shpg. Wt. 1 lb. Order No. 242

MULTI-BAND HY-Q TRAP DOUBLETS Hy-Q Traps
- **Install Horizontally or as Inverted V**
- **Super-Strength Aluminum Clad Wire**
- **Weatherproof Center and End Insulators**

Installed horizontally or as an inverted V, Hy-Gain doublets with Hy-Q traps deliver true half wavelength performance on every design frequency. Matched traps, individually pretuned for each band feature large diameter coils that develop an exceptionally favorable L/C ratio and very high Q performance. Mechanically superior solid aluminum trap housings provide maximum protection and support to the loading coil. Fed with 52 ohm coax, Hy-Gain doublets employ super-strength aluminum clad single strand steel wire elements that defy deterioration from salt water and smoke ... will not stretch ... withstand hurricane-like winds. SWR less than 1.5:1 on all bands. Strong, lightweight, weatherproof center insulators are molded from high impact cyolac. Hardware is iridate treated to MIL specs. Heavily serrated 7-inch end insulators molded from high impact cycolac increase leakage path to approximately 12 inches.

MODEL 2BDQ for 40 and 80 meters. 100' 10½" overall. Takes maximum legal power. Shpg. Wt., 7.5 lbs $49.95 Order No. 380

MODEL 5BDQ for 10, 15, 20, 40 and 80 meters. 94' overall. Takes maximum power. Shpg. Wt., 12.2 lbs. $79.95 Order No. 383

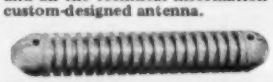
CENTER INSULATOR for Multi-Band Doublets Model CI

Strong lightweight, weatherproof Model CI is molded from high impact cycolac. Hardware is iridite treated to MIL specs. Accepts ¼" or ¾" coaxial. Shpg. Wt., 0.6 lbs. $5.95 Order No. 155

MULTI-BAND ANTENNA Dipole Antenna — Model DIV-80 $13.95 For 10 thru 80 meters — choice of one band

A dipole antenna for the individuals who prefer the "do-it-yourself" flexibility of custom-designing an antenna for your specific needs. (Work the frequencies you wish in the 10 through 80 meters bands).

The DIV-80 features: Durable Copperweld wire for greater strength, Mosley Dipole Connector (DPC-1) for RG-8/U or RG-58/U coax and all the technical information you will need to construct your custom-designed antenna.



END INSULATORS for Doublets Model EI

Rugged 7-inch end insulators are molded from high impact cycolac that is heavily serrated to increase leakage path to approximately 12 inches. Available in pairs only. Shpg. Wt., 0.4 lbs. $3.95 Order No. 156

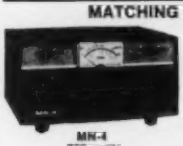
- *Remote*
- *Motor Controlled*

RCS-4

COAX ANTENNA SWITCH

- Control unit works on 110/220 VAC, 50/60 Hz, and supplies necessary DC to motor.
- Excellent for single coax feed to multiband quads or arrays of monobanders. The five positions allow a single coax feed to three beams and two dipoles, or other similar combinations.
- Control cable (not supplied) same as for HAM-M rotator.
- Selects antennas remotely, grounds all unused antennas. GND position grounds all antennas when leaving station. "Rain-Hat" construction shields motor and switches.
- Motor: 24 VAC, 2 amp. Lubrication good to −40°F.
- Switch RF Capability: Maximum legal limit. **Price: $120.00**

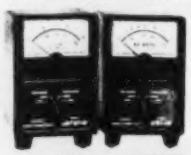
MATCHING NETWORKS



MN-4
200 watts
Price: $110.00

MN-2000
2000 watts PEP
Price: $220.00

General: ● **Integral Wattmeter** reads forward power in watts and VSWR directly; can be calibrated to read reflected power ● **Matches 50 ohm transmitter output** to coax antenna feedline with VSWR of at least 5:1 ● Covers ham bands 80 thru 10 meters ● **Switches in or out** with front panel switch ● **Size:** 5½"H, 10¾"W, 8"D (14.0 x 27.3 x 20.3 cm), MN-2000, 14¾"D (36.5 cm).
● **Continuous Duty Output:** MN-4, 200 watts; MN-2000, 1000 watts (2000 watts PEP) ● **MN-2000 only:** Up to 3 antenna connectors selected by front panel switch.



RF WATTMETERS

W-4 1.8-54 MHz **Price: $ 72.00**
WV-4 20-200 MHz **Price: $ 84.00**

Reads forward and reflected power directly in watts (VSWR from nomogram). Two scales in each direction. **Size:** 5½"H, 3¾"W, 4"D (14.0 x 9.5 x 10.2 cm).

Model	Full Scale	Calibration Accuracy
W-4	200 watts	±(5% of reading + 2 watts)
	2000 watts	±(5% of reading + 20 watts)
WV-4	100 watts	±(5% of reading + 1 watt)
	1000 watts	±(5% of reading + 10 watts)

DRAKE

SSR-1 COMMUNICATIONS RECEIVER

- **Synthesized • General Coverage**
- **Low Cost • All Solid State • Built-in AC Power Supply • Selectable Sidebands**
- **Excellent Performance**

PRELIMINARY SPECIFICATIONS: ● **Coverage:** 500 kHz to 30 MHz ● **Frequency** can be read accurately to better than 5 kHz ● **Sensitivity** typically .5 microvolts for 10 dB S+N/N SSB and better than 2 microvolts for 10 dB S+N/N AM ● **Selectable sidebands** ● **Built-in power supply:** 117/234 VAC ± 20% ● **If the AC power source fails** the unit switches automatically to an internal battery pack which uses eight D-cells (not supplied) ● **For reduced current drain** on DC operation the dials do not light up unless a red pushbutton on the front panel is depressed.

The performance, versatility, size and low cost of the SSR-1 make it ideal for use as a stand-by amateur or novice-amateur receiver, short wave receiver, CB monitor receiver, or general purpose laboratory receiver.

Price: $350.00

GENERAL: ● **All amateur bands** 10 thru 80 meters in seven 600 kHz ranges ● **Solid State VFO** with 1 kHz dial divisions ● **Modes** SSB Upper and Lower, CW and AM ● **Built-in Sideband** and automatic T/R switching on CW ● **30 tubes and semi-conductors** ● **Dimensions:** 5½"H, 10¾"W, 14¾" D (14.0 x 27.3 x 36.5 cm). **Wt.:** 16 lbs. (7.3 kg).
TRANSMIT: ● **VOX** or **PTT** on SSB or AM ● **Input Power:** SSB, 300 watts P.E.P.; AM, 260 watts P.E.P. controlled carrier compatible with SSB linears; CW, 260 watts ● **Adjustable pi-network.**
RECEIVE: ● **Sensitivity** better than ½ μV for 10 dB S/N ● I.F. **Selectivity** 2.1 kHz @ 6 dB, 3.6 kHz @ 60 dB. ● **AGC** full on receive modes, variable with RF gain control, fast attack and slow release with noise pulse suppression ● **Diode Detector** for AM reception.

Price: $649.00

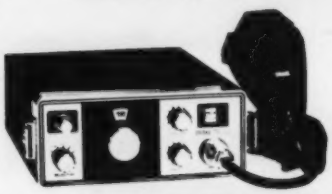
TR-4CW SIDEBAND TRANSCEIVER

34-PNB Plug-in Noise Blanker	100.00
FF-1 Crystal Control Unit	46.95
MMK-3 Mobile Mount	7.00
RV-4C Remote VFO	120.00

POWER SUPPLIES

AC-4 Power Supply	$120.00
DC-4 Power Supply	135.00

2 METER FM PORTABLE TRANSCEIVER Model TR-33C



Amateur Net $229.95

- SCPC* Frequency Control
- 12 Channels with Selectable Xmtr Offsets.
- All FET Front-end and Crystal Filter for Superb Receiver Intermod Rejection.
- Expanded Antenna Choice.
- Low Receiver Battery Drain.
- Traditional R. L. Drake Service Backup.
- Single Crystal Per Channel.

LINEAR AMPLIFIER Model L-4B

L-4B Linear Amplifier **895.00**
● **2000 Watts PEP-SSB** ● **Class B Grounded-Grid — two 3-500Z Tubes** ● **Broad Band Tuned-Input** ● **RF Negative Feedback** ● **Transmitting AGC** ● **Directional Wattmeter** ● **Two Tautband Suspension Meters** ● **L-4B 13-15/16" W, 7-7/8" H, 14-5/16" D. Wt.: 32 lbs.** ● **Power Supply 6-3/4" W, 7-7/8" H, 11" D, Wt.: 43 lbs.**

POWER SUPPLIES

AC 4 Power Supply	$120.00
DC 4 Power Supply	135.00

Touch-n-go with DRAKE 1525EM Push Button Encoding Mike

Drake 1525EM, microphone with tone encoder and connector for TR-33C, TR-22, TR-22C, ML-2 ..... $49.95

- Microphone and auto-patch encoder in single convenient package with coil cord and connector. Fully wired and ready for use.
- High accuracy IC tone generator, no frequency adjustments.
- High reliability Digitran® keyboard.
- Power for tone encoder obtained from transceiver through microphone cable. No battery required. Low current drain.
- Low output impedance allows use with almost all transceivers.
- Four pin microphone plug: directly connects to Drake TR-33C without any modification in transceiver. Compatible with all previous Drake and other 2 meter units with minor modifications.
- Tone level adjustable.
- Hang-up hook supplied.

why waste watts?

(SWR-1A $24.95)

SWR-1 guards against power loss

If you're not pumping out all the power you're paying for, our little SWR-1 combination power meter and SWR bridge will tell you so. You read forward and reflected power simultaneously, up to 1000 watts RF and 1:1 to infinity VSWR at 3.5 to 150 MHz.

Got it all tuned up? Keep it that way with SWR-1. You can leave it right in your antenna circuit.

SWAN ELECTRONICS
A subsidiary of Cubic Corporation

DELUXE 742 TRI-BAND MOBILE ANTENNA

- Automatically adjusts to proper resonance for 20, 40 and 75 meters.
- Power rated at 500 Watts P.E.P.
- Includes base section, automaticoil and whip top section. 742 Antenna

Price: $109.95

EXCLUSIVE DELUXE S-BAND MOBILE 45 ANTENNA

- All band manual switching antenna for 10, 15, 20, 40 and 75 meters.
- Power rated at 1000 Watts P.E.P.
- Includes base section with mobilecoil and six foot whip top section. 45 Antenna

Price: $119.95

JMR MOBIL-EAR™

Two-way-radio headset with superior fidelity Electret-Capacitor boom microphone and palm-held talk switch.

$69.95

FOR BROADCAST-QUALITY TRANSMISSION AND RECEPTION FOR BOTH MOBILE UNITS AND BASE STATIONS.

- Boom-mounted electret-capacitor microphone delivers studio-quality, undistorted voice reproduction. Variable gain control lets you adjust for optimum modulation.
- Cushioned earcup lets you monitor in privacy – no speaker blare to disturb others. Blocks out environmental noises, too. Made of unbreakable ABS plastic.
- Headband self-adjusts for comfortable wear over long hours. Spring-flex hinge lets you slip headset on and off with just one hand. Reversible for right or left ear.
- Headset can be hung on standard microphone clip.
- Compact palm-held talk switch lets you keep *both* hands on the wheel for safer driving. Made of unbreakable ABS plastic.
- Built-in FET transistor amplifier adapts microphone output to any transceiver impedance.
- Compatible with most two-way radios including 40-channel CB units.
- Built-in Velcro pad for easy mounting of the talk switch.
- Made in U.S.A.

SPECIFICATIONS

Earphone impedance and type:	8 ohms, dynamic
Microphone type:	Electret capacitor
Microphone frequency response:	200-6000 Hz
Amplifier type:	FET transistor, variable gain
Amplifier battery power:	7-volt Mallory TR-175
Switching:	Relay or electronic

IDEAL FOR EVERY TWO-WAY RADIO COMMUNICATIONS NEED . . .

CB operators • Amateur radio operators • Police and fire vehicles • Ambulances and emergency vehicles • Taxis and truckers • Marine pleasure and work boats • Construction and demolition crews • Industrial communications • Security patrols • Airport tower and ground crews • Remote broadcast and TV-camera crews • Foresters and fire-watch units •

SWAN METERS HELP YOU GET IT ALL TOGETHER

These wattmeters tell you what's going on.

With one of these in-line wattmeters you'll know if you're getting it all together all the time. Need high accuracy? High power handling? Peak power readings? For whatever purpose we've got the wattmeter for you. Use your Swan credit card. Applications at your dealer or write to us.

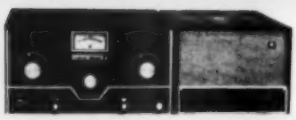
WM1500 In-line Watt-meter With Muscle. Scales to 2000 watts. New flat response directional coupler for maximum accuracy. $59.95

WM1000 Peak reading Wattmeter. Reads avg. power then with the flick of a switch, true peak power of your single-sideband signal. That's what counts on SSB. $79.95

WM1500 High-Accuracy In-line Wattmeter. 10% full scale accuracy on 5, 50, 500 and 1500 watt scales, 2 to 30 MHz. Forward and reflected power. Use it for trouble-shooting, too. $71.95

SWAN ELECTRONICS
A subsidiary of Cubic Corporation

SWAN LINEAR AMPLIFIERS A Mark II 2000 watt P.E.P. full legal input power unit or the 1200X matching Cygnet 1200 watt P.E.P. input powerhouse with built-in power supply. The choice is yours. $849.95



NEW Swan MMBX Impedance Matcher

It keeps your transmitter and your antenna on speaking terms for a song. Price: $23.95

CYGNET 1200X PORTABLE LINEAR AMPLIFIER

To quadruple the output of the 300B Cygnet *de novo*, simply add this matching unit for more than a kilowatt of power. Complete with self-contained power supply and provision for external ALC, this Cygnet offers exceptionally high efficiency and linearity. $349.95

Additional Swan products include: fixed and mobile antennas, VFO's telephone patch, VOX, wattmeter, microphones and mounting kits. As another extra service, only Swan Electronics offers factory-backed financing to the amateur radio community. Visit an authorized Swan Electronics dealer for complete details

SWAN ELECTRONICS

TEN-TEC

ARGONAUT #509

AMPLIFIER #405

ARGONAUT, MODEL 509

Covers all Amateur bands 10-80 meters. 9 MHz crystal filter. 2.5 kHz bandwidth. 1.7 shape factor @ 6/50 dB points. Power required 12-15 VDC @ 150 mA receive, 800 mA transmit at rated output. Construction: aluminum chassis, top and front panel, molded plastic end panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 13" x 7". Weight 6 lbs.

LINEAR AMPLIFIER, MODEL 405

Covers all Amateur bands 10-80 meters. 50 watts output power, continuous sine wave. RF wattmeter, SWR meter. Power required 12-15 VDC @ 8 A, max. Construction: aluminum chassis, top and front panel, molded plastic side panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 7" x 8". Weight 2½ lbs.

Argonaut, Model 509	**$329.00**
Linear Amplifier, Model 405	**159.00**
Power Supply, Model 251 (Will power both units)	**79.00**
Power Supply, Model 210 (Will power Argonaut only)	**27.50**

The new ultra-modern fully solid-state TRITON makes operating easier and a lot more fun, without the limitations of vacuum tubes.

For one thing, you can change bands with the flick of a switch and no danger of off-resonance damage. And no deterioration of performance with age.

But that's not all. A superlative 8-pole i-f filter and less than 2% audio distortion, transmitting and receiving, makes it the smoothest and cleanest signal on the air.

The TRITON IV specifications are impeccable. For selectivity, stability and receiver sensitivity. And it has features such as *full* CW break-in, pre-selectable ALC, off-set tuning, separate AC power supply, 12 VDC operation, perfectly shaped CW wave form, built-in SWR bridge and on and on.

For new standards of SSB and CW communication, write for full details or talk it over with your TEN-TEC dealer. We'd like to tell you why "They Don't Make 'Em Like They Used To" makes Ham Radio even more fun.

TRITON IV $699.00

ACCESSORIES:

Model 240 One-Sixty Converter	$ 97.00
Model 244 Digital Readout	197.00
Model 245 CW Filter	$ 25.00
Model 249 Noise Blanker	29.00
Model 252G Power Supply	99.00
Model 262G Power Supply/VOX	129.00

TEN-TEC

KR20-A ELECTRONIC KEYER

A fine instrument for all-around high performance electronic keying. Paddle actuation force is factory adjusted for rythmic smooth keying. Contact adjustments on front. Weighting factor factory set for optimum smoothness and articulation. Over-ride "straight key" conveniently located for emphasis, QRS sending or tune-up. Reed relay output. Side-tone generator with adjustable level. Self-completing characters. Plug-in circuit board. For 117 VAC, 50-60 Hz or 6-14 VDC. Finished in cream and walnut vinyl. Price $67.50

KR5-A ELECTRONIC KEYER

Similar to KR20-A but without side-tone oscillator or AC power supply. Ideal for portable, mobile or fixed station. A great value that will give years of troublefree service. Housed in an attractive case with cream front, walnut vinyl top. For 6-14 VDC operation. Price $38.50

KR1-A DELUXE DUAL PADDLE

Paddle assembly is that used in the KR50, housed in an attractive formed aluminum case. Price $35.00

KR2-A SINGLE LEVER PADDLE

For keying conventional "TO" or discrete character keyers, as used in the KR20-A. Price $15.00

KR50 ELECTRONIC KEYER

A completely automatic electronic keyer fully adjustable to your operating style and preference, speed, touch and weithting, the ratio of the length of dits and dahs to the space between them. Self-controlled keyer to transmit your thoughts clearly, articulately and almost effortless. The jambie (squeeze) feature allows the insertion of dits and dahs with perfect timing.

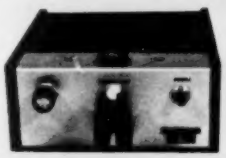
An automatic weighting system provides increased character to space ratio at slower speeds, decreasing as the speed is increased, keeping the balance between smoothness at low speeds and easy to copy higher speed. High intelligibility and rythmic transmission is maintained at all speeds, automatically.

Memories provided for both dits and dahs but either may be defeated by switches on the rear panel. Thus, the KR50 may be operated as a full iambic (squeeze) keyer, with a single memory or as a conventional type keyer. All characters are self-completing. Price $110.00

SPECIFICATIONS

Speed Range: 6-50 w.p.m.
Weighting Ratio Range: 50% to 150% of classical dit length.
Memories: Dit and dah. Individual defeat switches.
Paddle Actuation Force: 5-50 gms.
Power Source: 117VAC, 50-60 Hz, 6-14 VDC.
Finish: Cream front, walnut vinyl top and side panel trim.
Output: Reed relay. Contact rating 15 VA, 400 V. max.
Paddles: Torque drive with ball bearing pivot.
Side-tone: 500 Hz tone.
Adjustable output to 1 volt.
Size HWD: 2½" x 5¼" x 8¼"
Weight: 1¼ lbs.

TEN-TEC



KR50

NORTH SHORE RF TECHNOLOGY

DUPLEXER & CAVITY KITS...

NOW AVAILABLE FOR YOU FULLY ASSEMBLED & TUNED!

- UPGRADE YOUR REPEATER WITH AN RF TECHNOLOGY DUPLEXER.
- ALL DUPLEXERS AND CAVITIES ARE TEMPERATURE COMPENSATED WITH INVAR® AND MEET ALL COMMERCIAL STANDARDS
- ONLY TOP QUALITY MATERIALS GO INTO OUR PRODUCTS.
- BOTH KITS & ASSEMBLED DUPLEXERS AND CAVITIES ARE AVAILABLE TO YOU AT A SAVINGS TO YOU.

Mod. 62-3 . . . 6 cav., 2 mtr., insertion loss 0.6 db with isolation 100 db typical; pwr. 350 w. Kit $399 ea. — Assembled $499.

Mod. 4220-3 . . . 4 cav. 220 MHz insertion loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kit $279 ea. — Assembled $349.

Mod. 4440-3 . . . 4 cav. 440 MHz, insertion loss 0.6 db with 80 db isolation loss 0.6 db with 80 db isolation typical; pwr. 350 w. Kits $249 ea. — Assembled $329.

Mod. 30 Cavity Kits: 2 mtr. $75 ea., 220 MHz $65 ea., 440 MHz $65 ea.; 6 mtr. $115 ea. Add $15 for Assembled Kit.

Also available: 6 mtr., 4 cav. Kit $399 — Assembled $499, 2 mtr. 4 cav. Kit $299 — Assembled $399, 440 MHz TV Repeater Duplexer.

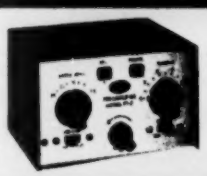
Now You Can Receive The Weak Signals With The ALL NEW AMECO PREAMPLIFIER

Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with No modification. No serious ham can be without one.

- Improves sensitivity and signal-to-noise ratio.
- Boosts signals up to 26 db.
- For AM or SSB.
- Bypasses itself automatically when the transceiver is transmitting.
- FET amplifier gives superior cross modulation protection.
- Advanced solid-state circuitry.
- Simple to install.
- Improves immunity to transceiver front-end overload by use of its built-in attenuator.
- Provides master power control for station equipment.

MODEL PT-2

$69.95



TUFTS RADIO CATALOG TUFTS RADIO

The indispensable BIRD model 43 THRULINE® Wattmeter

MODEL		PRICE
43		$110
Elements (Table 1) 2-30 MHz		40
Elements (Table 1) 25-1000 MHz		35
Elements (Table 2)		50
80F, 80M	5W	27
8080 QC-N (M)	25W	47
8085 QC-N (M)	50W	75
Minimonitor®		149

Read RF Watts Directly.

0.45-2300 MHz, 1-10,000 watts ±5%, Low Insertion VSWR—1.05.

Unequalled economy and flexibility: Buy only the element(s) covering your present frequency and power needs, add extra ranges later if yc ir requirements expand.

BIRD

Table 1 STANDARD ELEMENTS (CATALOG NUMBERS)

Power Range	Frequency Bands (MHz) 2-30	25-60	50-125	100-250	200-500	400-1000
5 watts	—	5A	5B	5C	5D	5E
10 watts	—	10A	10B	10C	10D	10E
25 watts	—	25A	25B	25C	25D	25E
50 watts	50H	50A	50B	50C	50D	50E
100 watts	100H	100A	100B	100C	100D	100E
250 watts	250H	250A	250B	250C	250D	250E
500 watts	500H	500A	500B	500C	500D	500E
1000 watts	1000H	1000A	1000B	1000C	1000D	1000E
2500 watts	2500H					
5000 watts	5000H					

Table 2 LOW-POWER ELEMENTS

1 watt	Cat. No.	2.5 watts	Cat. No.
60-80 MHz	060-1	60-80 MHz	060-2
80-95 MHz	080-1	80-95 MHz	080-2
95-125 MHz	095-1	95-150 MHz	095-2
110-160 MHz	110-1	150-250 MHz	150-2
150-250 MHz	150-1	200-300 MHz	200-2
200-300 MHz	200-1	250-450 MHz	250-2
275-450 MHz	275-1	400-850 MHz	400-2
425-850 MHz	425-1	800-950 MHz	800-2
800-950 MHz	800-1		

BOMAR Crystal Company

Novice Crystals (Specify Band Only)

TWO METERS

CRYSTALS IN STOCK

Motorola HT 220 Crystals In Stock!

Standard ● Icom ● Heathkit ● Ken ● Clegg ● Regency ● Wilson ● VHF Eng ● Drake ● And Others!

$4.50 @ Lifetime Guarantee

Make/Model	Xmit Freq.	Rec. Freq.

THE BIG SIGNAL "W2AU" BALUN $12.95

THE APPROVED LEADING HAM AND COMMERCIAL BALUN IN THE WORLD TODAY.

THE PROVEN BALUN

1. HANDLES FULL 2 KW PEP AND THEN SOME. Broad-Banded 3 to 40 Mc.
2. HELPS TVI PROBLEMS By Reducing Coax Line Radiation
3. HOW ALL STAINLESS STEEL HARDWARE, 302/304 Double Silver Plated
4. IMPROVES F/B RATIO By Reducing Coax Line Pick-Up.
5. REPLACES CENTER INSULATOR. Withstands Antenna Pull of Over 600 Lbs.
6. BUILT-IN LIGHTNING ARRESTER. Helps Protect Balun — Could Also Save Your Valuable Gear
7. BUILT-IN BANG-UP HOOK. Ideal For Inverted Vees, Multi-Band Antennas, Doubles, Beam and Quads

NOW BEING USED BY ALL BRANCHES OF THE U.S. ARMED FORCES, FAA, RCA, CIA, CANADIAN DEFENSE DEPT. PLUS THOUSANDS OF HAMS THE WORLD OVER

THEY'RE BUILT TO LAST...

BIG SIGNALS DON'T JUST HAPPEN— GIVE YOUR ANTENNA A BREAK

Comes in 2 models. 1-1 matches 50 or 75 ohm unbalanced coax feed to 50 or 75 ohm balanced load. 4-1 model matches 50 or 75 ohm unbalanced coax feed to 200 or 300 ohm balanced load.

AVAILABLE AT ALL LEADING DEALERS. IF NOT, ORDER DIRECT

The big signal W2AU Balun reflects the type of quality that has kept our product out front and number 1 in Baluns the world over for the past 10 years.

The originator of the Balun with a built-in lightning arrester and hang up hook.

IT'S WHAT'S INSIDE THAT COUNTS!

We'll GUARANTEE no other balun, at any price, has all these features.

SERIES 31 — BNC CONNECTORS

Amphenol's BNC connectors are small, lightweight, weatherproof connectors with bayonet action for quick disconnect applications.

Shells, coupling rings and male contacts are accurately machined from brass. Springs are made of beryllium copper. All parts in turn are ASTROplated® to give you connectors that can take constant handling, high temperatures and resist abrasion.

UG-1094

UG-255

575-102-385

BNC BULKHEAD RECEPTACLE 31-221-385 UG-1094 Mates with any BNC plug. Receptacle can be mounted into panels up to 104" thick. $1.25

BNC (M) TO UHF (F) ADAPTER 309-2900-385 UG-225 Adapts any BNC jack to any UHF plug. $3.63

DOUBLE MATE ADAPTER 83-877-385 Both coupling rings are free turning. Connects 2 female components. $2.72

JACK ADPATER $1.95

575-102-385 Adapts 83-1SP-385 to Motorola type auto antenna jack or pin jack.

PANEL RECEPTACLE 83-1R-385 SO239 Mounts with 4 fasteners in 21/32" diameter hole. $1.17

PANEL RECEPTACLE 83-878-385 SO239SH Mounts in single 21/32" diameter hole. Knurled lock nuts prevent turning. $1.59

BNC ANGLE ADAPTER 31-009-385 UG-306 Adapts any BNC plug for right angle use. $4.23

BNC TEE ADAPTER 31-008-385 UG-274 Adapts 2 BNC plugs to 31-003-385 or other female BNC type receptable. $4.56

BNC(F) TO UHF (M) ADAPTER 31-028-385 UG-273 Adapts any BNC plug to any UHF jack. $2.39

PUSH-ON 83-1SP-385 83-5SP-385 Features an unthreaded, springy shell to push fit on female connectors. $2.27

LIGHTNING ARRESTOR 575-105-385 Eliminates static build-up from antenna. Protects your valuable equipment against lightning damage. $4.80

BNC PLUG 31-002-385 UG-88 Commonly used for communications antenna lead cables. For RG 55/U & RG 58/U cables. $1.59

BNC STRAIGHT ADAPTER 31-219-385 UG-914 1 9/32" long, allows length of cables to be joined. Mates with BNC plugs. $2.12

BNC PANEL RECEPTACLE 31-003-385 UG-290 Mounts with 4 fasteners in 29/64" diameter hole. $1.74

SERIES 581 — PACKAGED CABLE ASSEMBLIES

All popular lengths are now available in your choice of RG 8/U or RG 58/U type low loss polyfoam dielectric cable. Installed PL-259 connectors are ASTROplated — Amphenol's new non-tarnishing finish — which has all the advantages of precious metal plus more heat, corrosion and abrasion resistors that silver ever had! These cable assemblies are ideal for CB, ham radio and other communications antenna installations and they are ready for immediate use.

RG 8/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-803 3-ft. with ASTROplated PL-259's on both ends. $5.60

581-820 20-fit with ASTROplated PL-259's on both ends. $11.80

581-850 50-fit with ASTROplated PL-259's on both ends. $23.10

581-875 75-fit with ASTROplated PL-259's on both ends. $30.30

581-8100 100-ft. with ASTROplated PL-259's on both ends. $38.50

RG 58/U TYPE POLYFOAM COAXIAL CABLE ASSEMBLIES 581-5812 12-ft. with ASTROplated PL-259's on both ends. $6.34

581-5820 20-ft with ASTROplated PL-259's on one end and SPADE LUGS ON OTHER END. $6.30

518-5820-2 20-ft. with ASTROplated PL-259's on both ends. $7.36

581-5850 50-ft. with ASTROplated PL-259's on both ends. $11.20

581-5875 75-ft. with ASTROplated PL-259's on both ends. $14.00

581-58100 100-ft. with ASTROplated PL-259's on both ends. $16.10

A new precision clock which tells time anywhere in the world at a glance, has been announced by **Yaesu Electronics Corporation**. The time in any principal city or time zone can be simultaneously coordinated with local time on a 24 hour basis. After the initial setting, as the clock runs, a Time Zone Hour Disc advances automatically, showing correct time all over the world without further adjustment. The clock is especially designed to withstand shock and may be hung on a wall or placed on its desk mount. The clock will run an entire year on a single 1.5 volt flashlight battery and the mechanism starts as soon as the battery is inserted. It measures six inches in diameter by two and one half inches deep. An excellent item for the business office, ham radio operator, short wave listener, boat owner, and others who want an accurate dependable clock.

Price: $30.00 Amateur net.

Now...more than ever--- the TEMPO line means solid value

Tempo VHF/ONE

the "ONE" you've been waiting for

$399.00

No need to wait any longer -- this is it! Whether you are already on 2-meter and want someting better or you're just thinking of getting into it, the VHF/ONE is the way to go.

• Full 2-meter band coverage (144 to 148 MHz for transmit and receive. • Full phase lock synthesized (PLL) so no channel crystals are required. • Compact and lightweight -- 9.5" long x 7" wide x 2.25" high. Weight -- About 4.8 lbs. • Provisions for an accessory SSB adaptor. • 5-digit LED receive frequency display. • 5 KHz frequency selection for FM operation. • Automatic repeater split -- selectable up or down for normal or reverse operation. • Microphone, power cord and mounting bracket included. • Two built-in programmable channels. • All solid state. • 10 watts output. • Super selectivity with a crystal filter at the first I/F and E type ceramic filter at the second I/F. • 800 Selectable receive frequencies. • Accessory 9-pin socket.

TEMPO SSB/CWa

$199.00

SSB adapter for the Tempo VHF/One

• Selectable upper or lower sideband. • Plugs directly into the VHF/One with no modification. • Noise blanker built-in. • RIT and VXO for full frequency coverage. •

ATLAS 350-XL

- ALL SOLID STATE
- SSB TRANSCEIVER
- 350 WATTS P.E.P. OR CW INPUT
- 10 THROUGH 160 METER COVERAGE

Illustrated with optional AC supply, Auxiliary VFO, and Digital Dial.

The all new Atlas 350-XL has all the exciting new features you want, plus superior performance and selectivity control never before possible.

● 10-160 METERS
Full coverage of all six amateur bands in 500 kHz segments. Primary frequency control provides highly stable operation. Also included is provision for adding up to 10 additional 500 kHz segments between 2 to 22 MHz by plugging in auxiliary crystals.

● 350 WATTS
P.E.P. and CW input. Enough power to work the world barefoot!

IDEAL FOR DESKTOP OR MOBILE OPERATION
Measuring just 5 in. high x 12 in. wide x 12½ in. deep, and weighing only 13 pounds, the Atlas 350-XL offers more features, performance and value than any other transceiver, regardless of size, on the market today!

● SELECTIVITY CONTROL
This amazing new breakthrough in filter design is truly the filter of the future. Selectivity control on the front panel provides control of bandwidth as well as selection of upper or lower sideband, or double sideband. Continuously variable from 300 to 2700 Hz bandwidth. Shape factor is better than 1.7, with ultimate rejection better than 130 dB. Selectivity for SSB can be set for maximum voice fidelity at 2700 Hz bandwidth, providing transmission and reception of audio from 300 to 3000 Hz, or it can be narrowed down to 2400, 2100 or even 1500 Hz if necessary to reduce adjacent channel QRM. Selectivity can be narrowed gradually to as little as 300 Hz for CW reception.

This amazing new breakthrough in filter design is by Bob Crawford and Eckert Argo of Consulting Engineers. Atlas Radio is privileged to be first to offer this "programmable filter" in the radio communication field and for sometime to come will be the only one.

- **RECEIVER INCREMENTAL TUNING**
- **AUDIO FREQUENCY NOTCH FILTER**
- **PUSH TO TALK**
- **VOX OPERATION**
- **FULL BREAK-IN CW OPERATION**

MODEL 350-XL $995

● DIGITAL DIAL READOUT
The Atlas 350-XL has space provided for quick installation of this plug-in accessory. Provides precise frequency readout within 50 Hz. All L.E.D. Dot Matrix 6 digit display.
DD6-XL DIGITAL DIAL $195

● PLUG-IN AUXILIARY VFO or CRYSTAL OSCILLATOR
Auxiliary VFO is plugged into the space provided on the front panel of the 350-XL. You have a second tuneable VFO with same tuning ranges as primary VFO for tuning to a separate transmit or receive frequency. LEDs indicate which VFO, primary or secondary, will be used for receive and transmit.

Or instead of the auxiliary VFO a Crystal Oscillator may be plugged into the front panel. Eleven crystal sockets are available with a vernier control for exact frequency setting.
MODEL 305 AUXILIARY VFO $155
MODEL 311 AUXILIARY CRYSTAL OSCILLATOR $135

● 350-PS MATCHING AC SUPPLY
Includes front facing speaker and phone jack. Provides 14 volts filtered and regulated D.C. for both low current and high current circuits of the 250-XL. Internal space provided for future installation of accessories such as CW Keyer, Speech Processor, Phone Patch, etc. Operates on 100-130 or 200-260 volts, 50-60 Hz . . $195

● SAME PLUG-IN-AND-GO MOBILE FEATURE AS OUR FAMOUS 210x/215x
The 350-XL has its own optional Mobile Mounting Bracket for quick, easy plug-in or removal from your car. All connections are made automatically $65

● ATLAS 210x/215x SSB TRANSCEIVERS
Our famous little compact SSB Transceivers remain a very important part of our product line $679
With noise blanker installed $719

No. 114-320-003 – $9.90
No. 114-322-003 – Brass – $10.30

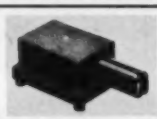
No. 114-320-001 – $8.35
No. 114-322-001 – Brass – $8.85

No. 114-310-003 – $8.25
No. 114-312-003 – Brass – $8.85

NYE VIKING SPEED-X KEYS

NYE VIKING Standard Speed-X keys feature smooth, adjustable bearings, heavy-duty silver contacts, and are mounted on a heavy oval die cast base with black wrinkle finish. Available with standard, or Navy knob, with, or without switch, and with nickel or brass plated key arm and hardware.

Pamper yourself with a Gold-Plated NYE VIKING KEY!
Model No. 114-31C-004GP has all the smooth action features of NYE Speed-X keys in a special "presentation" model. All hardware is heavily gold plated and it is mounted on onyx-like jet black plastic sub-base. List price is $50.00.



No. SSK-1 $23.95
No. SSK-1CP-Chrome – $29.95

NYE VIKING SQUEEZE KEY

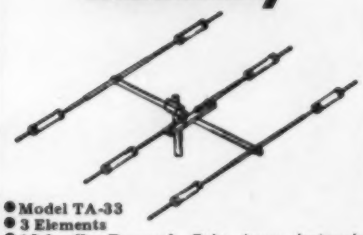
Extra-long, finger-fitting molded paddles with adjustable spring tension, adjustable contact spacing. Knife-edge bearings and extra large, gold plated silver contacts! Nickel plated brass hardware and heavy, die cast base with non-skid feet. Base and dust cover black crackle finished. SSK-1 — $23.45.
SSK-1CP has heavily chrome-plated base and dust cover. List price, $29.95.

CODE PRACTICE SET

You get a sure, smooth, Speed-X model 310-001 transmitting key, linear circuit oscillator and amplifier, with a built-in 2" speaker, all mounted on a heavy duty aluminum base with non-skid feet. Operates on standard 9V transistor type battery (not included). List price, $18.50.
PHONE PATCH Model No. 250-46-1 measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $36.50. Model 250-46-3, designed for use with transceivers having a built-in speaker, has its own built-in 2" x 6" 2 watt speaker. Measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $44.50.

TUFTS RADIO CATALOG TUFTS RADIO

Mosley



- Model TA-33
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

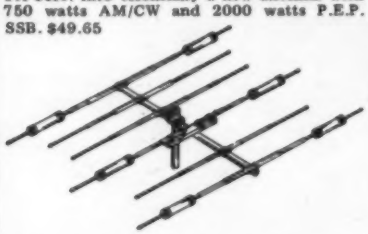
The Mosley TA-33, 3-element beam provides outstanding 10, 15 and 20 meter performance. Exceptionally broadband — gives excellent results over full Ham bandwidth. Incorporating Mosley Famous Trap-Master traps. Power Rating — 2KW P.E.P. SSB. The TA-33 may also be used on 40 meters with TA-40KR conversion. Complete with hardware. $198.15

MULTI-BAND BEAMS
TRAP MASTER 33 . . . 10, 15 & 20 Meters

- Model TA-33Jr.
- 3 Elements
- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

The TA-33Jr . . . incorporates Mosley Trap-Master Junior traps. This is the low power brother of the TA-33. Power Rating — 1 KW P.E.P. SSB. $144.45

TA-33JR. POWER CONVERSION KIT MODEL MPK-3
Owners of the Mosley Trap-Master TA-33Jr. may obtain higher power without buying an entirely new antenna. The addition of the MPK-3 (power conversion kit) converts the TA-33Jr. into essentially a new antenna with 750 watts AM/CW and 2000 watts P.E.P. SSB. $49.65



TRAP MASTER 36 . . . 10, 15 & 20 Meters

- Model TA-36
- 6 Elements
- Forward Gain (over isotropic source) - 10.1 db on 15 & 20 meters, 11.1 db on 10 meters.

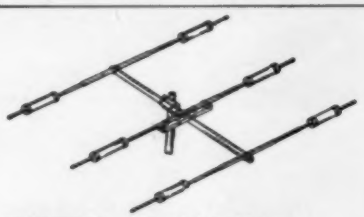
Front-to-Back Ratio on all bands. 20 db. This wide-spaced, six element configuration employs 4 operating elements on 10 meters, 3 operating elements on 15 meters, and 3 operating elements on 20 meters. Automatic bandswitching is accomplished through Mosley exclusively designed high impedance parallel resonant "Trap Circuit." The TA-36 is designed for 1000 watts AM/CW or 2000 watts P.E.P. SSB. Traps are weather and dirt proof, offering frequency stability under all weather conditions. $328.35

MOSLEY AK-60 MAST PLATE ADAPTER
Mast Plate Adapter for adapting your Mosley 1½" mounted beam to fit 2" OD mast. Complete with angle and hardware. $9.85

NATIONAL RADIO COMPANY, INC.
NRCI

NCL-2000
Linear Amplifier. A full 10 Db gain. 20 watts in 2000 watts out. Can be driven with one watt. Continuous duty design utilizes two 8122 ceramic tetrode output tubes, designed for both AM and SSB operation. The industry standard for 12 years. Thousands in use all over the world. Price: $1,200

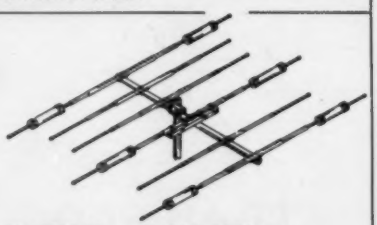
NCX-1000
The only 1000 watt, "single package" transceiver. Heavy duty design . . . results of 50 years of design leadership in amateur equipment. State of the art speech processing. linear amplifier, power supply, all in one package. Nothing extra to buy. Covers all amateur bands in HF spectrum . . . AM, SSB, CW. Price: $1,600



CLASSIC-33 . . . 10, 15 & 20 Meters
Model CL-33

- 3 Elements
- 10.1 db Forward Gain (over isotropic source) on all bands.
- 20 db Front-to-Back Ratio on 15 & 20 meters, 15 db on 10 meters.

BRIDGING THE GAP . . . The Classic 33, combines the best of two Mosley systems. Incorporating Mosley Classic Feed System for a "Balanced Capacitive Matching" system with a feed point impedance of 52 ohms at resonance, and the Famous Mosley Trap-Master Traps for "weather-proof" traps with resonant frequency stability. This extra sturdy multi-band beam, Model CL-33, for operation on 10, 15 & 20 meters features improved boom to element clamping, stainless steel hardware, balanced radiation and a longer boom for even wider element spacing. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Wind Load — 120 lbs. at 80 MPH. Approx. shipping weight — 45 lbs. $223.90



CLASSIC-36 . . . 10, 15 & 20 Meters
Model CL-36

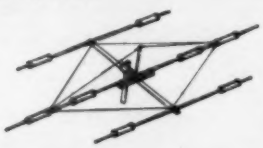
- 6 Elements
- 10.1 db Forward Gain (over isotropic source) on 15 & 20 meters, 11.1 db on 10 meters.
- 20 db Front-to-Back Ratio on all bands.

The Classic 36, like the smaller Classic 33, incorporates both the Mosley World-Famous Trap-Master Traps and the Mosley Classic Feed-System. Designed to operate on 10, 15 & 20 meters, this multi-band beam Model CL-36, employs the high standards of quality construction found in all Mosley products. The boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" system has a feed point impedance of 52 ohms at resonance. Wind Load — 210.1 lbs. at 80 MPH. Power Rating — 2 KW P.E.P. SSB. Recommended mast size — 2" OD. Approx. shipping weight — 71 lbs. via truck. $298.50

CLASSIC-203 . . . 20 Meters
Model CL-203
3 Elements

- 10.1 db Forward Gain (over isotropic source)
- 20 db Front-to-Back Ratio

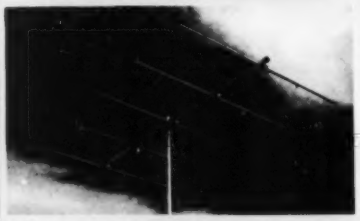
Incorporating the Mosley patented Classic Feed System, this full size 20 meter single-band beam has 1¼" to 3/8" dia. "swaged" elements wide spaced on a 2" dia. 24' boom. Maximum element length-37' 8½". The high standards in quality construction established by Mosley in over a quarter-century of manufacturing is reflected in this mono-band . . . Model CL-203. Boom-to-mast clamping assures stability with a time-tested arrangement of mast plate, cast aluminum clamping blocks and stainless steel U-bolts. The exclusive "Balanced Capacitive Matching" System has a nominal feed point impedance of 52 Ohms at 2 KW P.E.P. SSB. Recommended mast size-2" O.D. Approx. shipping wt: 42 lbs. via truck. $227.65



40 METER CONVERSION KIT MODEL TA-40KR
Work 40 meters in addition to 10, 15 & 20 meters by using a TA-40KR conversion kit on the radiator element of the TA-33 and TA-36. (Beams with broad band capacitive matching may not be converted!) Convert the TA-33Jr. with the MPK-3 (power conversion kit) before adding the TA-40KR kit. $88.45

SIGNAL-MASTER ANTENNA
Beam Antenna . . . Model S-402 for 40 meters
For a top signal needed to push through forty meter QRM, the Mosley Signal Master S-402 will do the trick! This 100% rust-proof 2-element beauty constructed of rugged heavy-wall aluminum is designed and engineered to provide the performance you need for both DX hunting and relaxing in a QRM free rag-chewing session. Beam is fed through link coupling, resulting in an excellent match over the entire bandwidth. $257.50

6 METER BEAMS



3 - 5 - 6 - 10 ELEMENTS

Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

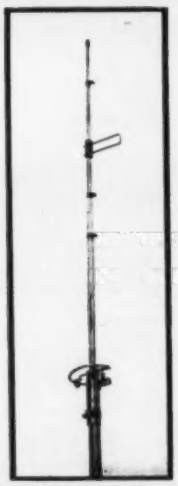
New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description	3 element	5 element	6 element	10 element
Model No.	A50-3	A50-5	A50-6	A50-10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	26 dB
Weight	7 lbs.	11 lbs.	18 lbs.	25 lbs.

new
RINGO RANGER *for* **FM**

4.5 dB* — 6 dB
Omnidirectional GAIN BASE STATION ANTENNAS

FOR MAXIMUM PERFORMANCE AND VALUE



Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this extende. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

ARX-2K CONVERSION KIT

2 METER ANTENNAS FM

A-FM RINGO 3.75 dB Gain (reference ¼ wave whip). Half wave length antennas with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install, 6 meter partly preassembled, all but 450 MHz take 1¼" mast. There are more Ringos in use than all other FM antennas combined.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-450
Power—Hdlg. Watts	100	500	100	100	250
Wind area sq. ft.	.21'	.21'	.37'	.39'	.10'

B-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 23' 220 MHz — 15', 435 MHz — 8', pattern 360° — 6 dB gain, 180° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting boom, harness and all hardware. Vertical support mast not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.56 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.85 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.13 sq. ft.

B-POWER PACK The big signal (22 element array) for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 24 dB, ½ power beamwidth 42°, dimensions 144" x 80" x 40", turn radius 69", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-22 145 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

D-YAGI STACKING KITS VPK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 3 dB gain over the single antenna.

A14-VPK,	complete 4 element stacking kit
A14-SK,	4 element coax harness only
A147-VPK,	complete 11 element stacking kit
A147-SK,	11 element coax harness only
A449-SK,	6 + 11 element coax harness only

E-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-259 connectors.

Model Number	A147-11	A-147-4	A449-11	A449-6	A220-11
Boom/Longest ele.	144"/40"	44"/40"	60"/13"	30"/26"	102"/26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 60"	3 lbs., 10"	5 lbs., 51"
Gain/F/B ratio dB	13.2/28	9/20	12.2/28	11/25	13.2/28
½ Power beam	48°	66°	48°	60°	48°
Wind area sq. ft.	1.21	.63	.29	.30	.59
Frequency MHz	146-148	146-148	449-450	449-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 120", weight 10 lbs., longest element 40", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS

3/4, 1-1/4, 2 METER BEAMS

The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the antennas have 3/16" O. D. solid aluminum elements with 5/16" center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O. D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O. D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144-7	A144-11	A220-11	A430-11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Lngth.	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	26 dB	28 dB	28 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

VHF/UHF BEAMS

A50-3	$ 32.95	A144-7	21.95
A50-5	49.95	A144-11	32.95
A50-6	69.95	A430-11	24.95
A50-10	99.95		

AMATEUR FM ANTENNAS

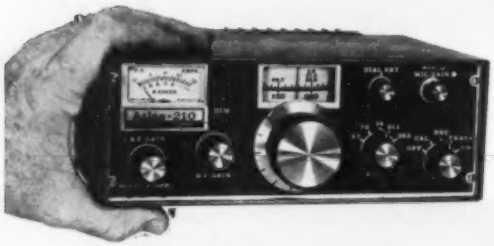
A147-4	$ 19.95	AFM-44D	54.95
A147-11	29.95	AR-2	21.95
A147-20T	54.95	AR-6	32.95
A147-22	84.95	AR-25	29.95
A220-7	21.95	AR-220	21.95
A220-11	27.95	AR-450	21.95
A449-6	21.95	ARX-2	32.95
A449-11	27.95	ARX-2K	13.95
AFM-4D	59.95	ARX-220	32.95
AFM-24D	57.95	ARX-450	32.95

Description:	144 MHz. Model:	Price:	220 MHz. Model:	Price:	432 MHz. Model:	Price:
20 Element DX-Array Frame & Harness (40 El.)	DX-120	42.95	DX-220	37.95	DX-420	32.95
	DXK-140	99.95	DXK-240	94.95	DXK-440	89.95
Frame & Harness (80 El.)	DXK-180	109.95	DXK-280	89.95	DXK-480	79.95
1-1 52-ohm balun	DX-1BN	12.95	DX-2BN	12.95	DX-4BN	12.95
Vert. Pol. Bracket (20 El.)	DX-VPB	9.95	DX-VPB	9.95	DX-VPB	9.95

TUFTS RADIO CATALOG TUFTS RADI

For all you hams with little cars ...

We've got the perfect mobile rig for you.



The Atlas 210x or 215x measures only 9½" wide x 9½" deep x only 3½" high, yet the above photograph shows how easily the Atlas transceiver fits into a compact car. And there's plenty of room to spare for VHF gear and other accessory equipment. With the exclusive Atlas plug-in design, you can slip your Atlas in and out of your car in a matter of seconds. All connections are made automatically.

BUT DON'T LET THE SMALL SIZE FOOL YOU!
Even though the Atlas 210x and 215x transceivers are less than half the size and weight of other HF transceivers, The Atlas is truly a giant in performance.

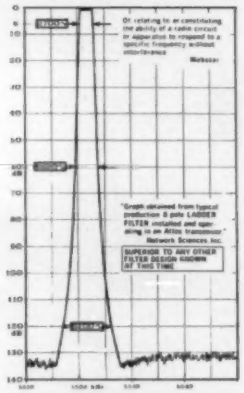
200 WATTS POWER RATING!
This power level in a seven pound transceiver is incredible but true. Atlas transceivers give you all the talk power you need to work the world barefoot. Signal reports constantly reflect great surprise at the signal strength in relation to the power rating.

FULL 5 BAND COVERAGE
The 210x covers 10-80 meters, while the 215x covers 15-160 meters. Adding the Atlas Model 10x Crystal Oscillator provides greatly increased frequency coverage for MARS and network operation.

NO TRANSMITTER TUNING OR LOADING CONTROLS
with Atlas' total broadbanding. With your Atlas you get instant QSY and band change.

MOST ADVANCED STATE OF THE ART SOLID STATE DESIGN
not only accounts for its light weight, but assures you years of top performance and trouble free operating pleasure.

PLUG-IN CIRCUIT BOARDS
and modular design provides for ease of servicing.


Graph obtained from typical production 8 pole LADDER FILTER installed and operating in an Atlas transceiver
Network Sciences Inc.
SUPERIOR TO ANY OTHER FILTER DESIGN KNOWN AT THIS TIME

PHENOMENAL SELECTIVITY
The exclusive 8 pole crystal ladder filter used in Atlas transceivers represents a major breakthrough in filter design, with unprecedented skirt selectivity and ultimate rejection. As the above graph shows, this filter provides a 6 db bandwidth of 2700 Hertz, 60 db down of only 4300 Hertz, and a bandwidth of only 9200 Hertz at 120 db down! Ultimate rejection is in excess of 130 db; greater than the measuring limits of most test equipment.

EXCEPTIONAL IMMUNITY TO STRONG SIGNAL OVERLOAD AND CROSS MODULATION. The exclusive front end design in the receiver allows you to operate closer in frequency to strong neighboring signals than you have ever experienced before. If you have not yet operated an Atlas transceiver in a crowded band and compared it with any other receiver or transceiver, you have a real thrill coming.

A WORLD WIDE DEALER NETWORK TO SERVE YOU.
Whether you're driving a Honda in Kansas City or a Mercedes Benz in West Germany, there's an Atlas dealer near you.

Atlas 210x or 215x	$675.00
W/Noise Blanker	719.00
ACCESSORIES:	
AC Console 110/220 V	$147.00
Portable AC supply 110/220 V	100.00
Plug-in Mobile Kit	48.00
10x Osc. less crystals	59.00
Digital Dial DD-6B	229.00

For complete details see your Atlas dealer, or drop us a card and we'll mail you a brochure with dealer list.

ATLAS RADIO INC.

mounts - leads - accessories

STANDARD GAIN MOBILES
Two Meters

- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—200 watts FM

MODEL SBLT-144
47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $33.75

MODEL SBL-144
47" antenna mounts on any flat surface, roof, deck or fender in ⅜" hole. Includes impact spring, 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount.
Price: $31.65

HUSTLER "BUCK-BUSTER"

MODEL BF-2
51" two meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ¾"-24 base to fit your mount or a wide selection of Hustler mobile mounts. (Mount or cable not included).
Price: $9.00

DELUXE MOBILE MOUNTS
For medium length, light weight antennas with ¾" — 24 base.

MODEL TLM
Trunk lip mount for no holes installation on side or edge of trunk lid. Includes 17' RG-58-U connectors attached.
Price: $14.95

MODEL HLM
Deluxe trunk lip mount with 180 degree swivel ball for positioning antenna to vertical. Easy — no holes — installation. Includes 17' RG-58-U cable and connectors attached. **Price: $17.20**

MODEL GCM-1
Rain gutter mount fits all shapes, angles over tallest trim. Includes 180° swivel ball. **Price: $9.00**

MODEL MM-1
Cowl mount installs in 1" hole. Includes 180° swivel ball and SO-239 connectors.
Price: $7.80

MODEL TGM-1
Trunk groove mount installs in hidden area of groove under trunk lid. Mounting hardware included. **Price: $8.00**

HUSTLER

SUPER GAIN MOBILES
Two Meters

- 5.2 db gain over 1/4 wave mobile antenna
- Frequency coverage—140-149 MHz
- SWR at resonance—1.1:1 typical
- Power rating—200 watts FM

TWO AND SIX METERS—TRUNK LIP MOUNT
MODEL MFT
Four section telescopic antenna permits separate adjustment for simultaneous resonance on two and six meters. Operational height: 48". Complete with trunk lip mount, 17' MIL SPEC RG-58-U and factory attached PL-259.
Price: $22.50

VHF/UHF ANTENNA—ROOF MOUNT
MODEL UHT-1
Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ⅜" hole. Includes 15' RG-58-U.
Price: $9.95

RESONATOR SPRING—STAINLESS STEEL
MODEL RSS-1
Instantly between Hustler mast and resonator. Absorbs shock when antenna strikes overhanging obstructions. Supplied ready for easy installation.

MODEL CST-144
Get big signal performance, superior receiving capability with this 85" coilmaster antenna. Easy installation on side or edge of trunk lip without drilling — complete with 17' MIL SPEC RG-58-U and PL-259.
Price: $41.30

MODEL CG-144
Same characteristics as CGT-144 supplied with ¾"-24 base to fit all mobile ball mounts — Length is 85". Mount and cable not included. **Price: $25.50**

VHF/UHF ANTENNA—TRUNK LIP MOUNT
MODEL THF
Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259. **Price: $10.55**

STAINLESS STEEL BALL MOUNT FOR DECK, FENDER OR ANY FLAT SURFACE
MODEL SSM-2
Heavy 2" reinforced stainless steel 180° adjustable ball mount easily supports any amateur mobile antenna. Includes combo base, steel lock-washer and mounting hardware.
Price: $19.20

QUICK DISCONNECT—¾"-24 STAINLESS STEEL
MODEL QD-1
Removes antenna from mount with easy press and twist release. Compression spring and all parts 300% stainless steel. ¾"-24 threads—female one end, male the other.
Price: $16.95

FEED LINE MODEL L-14-240
Low known performance, maximum shielding for minimum noise pick-up in this MIL SPEC 95 ohm coax of RG-58/U. Cable supplied with connectors at factory for use with ball or bumper mount and transceiver.
Price: $6.85

MODEL GS-144A — Deluxe, two meter Colinear for Repeater or any fixed station operation. 6 db gain over a ¼ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator: ⅝ wave lower section, ¼ wave phasing, ⅝ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¼" O.D. SO-239 coax connector
Price: $67.55

MODEL C-3B
Ball mount complete with mounting hardware.
Price: $6.20

All resonators are precision wound with optimized design for each band. Assembly includes 17-7 PH stainless steel adjustable tip rod for lowest SWR and band edge marker. Choose for medium or high power operation.

STANDARD HUSTLER RESONATORS
Power Rating: 400 Watts SSB

Model	Band	Price
RM-10	10 meters	$ 6.50
RM-15	15 meters	6.95
RM-20	20 meters	7.30
RM-40	40 meters	13.20
RM-75	75 meters	15.50
RM-80	80 meters	15.95

SUPER HUSTLER RESONATORS
Power Rating: Legal Limit SSB
Supers have widest bandwidth

Model	Band	Price
RM-10S	10 meters	$11.30
RM-15S	15 meters	12.65
RM-20S	20 meters	13.00
RM-40S	40 meters	15.50
RM-75S	75 meters	30.00
RM-80S	80 meters	30.40

For 6-10-15-20-40-75-80 Meters

Fold over mast for quick and easy interchange of resonators or entering a garage. When operating, mast is held vertical with shakeproof sleeve clutch. 54" mast also serves as 1/4 wavelength 6 meter antenna. Stainless steel base has ¾"-24 threads to fit mobile ball mount or bumper mount.

HUSTLER MASTS
The Majority Choice of Amateurs Throughout the World!

MODEL MO-1
For bumper mounting—Fold is at roof line 27" above base. **Price: $22.00**

MODEL MO-1
For deck or fender mounting—Fold is at roof line 15" above base. **Price: $22.00**

Covers 10 - 15 - 20 - 40 Meters
Only Hustler Gives One Setting for Whole Band Coverage

MODEL 4-BTV
- Lowest SWR—PLUS.
- Bandwidth at its broadest! SWR 1.8 to 1 or better at band edges.
- Hustler exclusive trap covers "Spirlz" extruded to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch fiberglass trap forms for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with low loss — high strength insulators. Mounting hardware included.
- All sections 1¼" heavy wall, high strength aluminum.
- Stainless steel clamps permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be easiest assembly of any multi-band vertical.
- Antenna has ¾"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for 75 meter operation when desired.
- Top loading on 75 meters for broader bandwidth and higher radiation efficiency!
- Feed with any length 50 ohm coax.
- Power capability—full legal limit on SSB or CW.
- Mounting: Ground mount with or without radials, or roof mount with radials.

Length: 21' 9"
MODEL 4-BTV
Weight: 15 lbs.
Price: $99.95

SUPER AMP from DenTron

If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI shielding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4-5728's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all

$574.50

The 80-10 Skymatcher

Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- SO–239 receptional to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W. 5" H. 8" D., Weight: 5 lbs.

$59.50

Read forward and reflected watts at the same time

Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

Match everything from 160 to 10 with the new 160-10 MAT

NEW: The Monitor Tuner was designed because of overwhelming demand. Hams told us they wanted a 3 kilowatt tuner with a built-in wattmeter, a front panel antenna selector for coax, balanced line and random wire. So we engineered the 160-10m Monitor Tuner. It's a lifetime investment at $299.50.

$299.50

Meet the SuperTuner

The DenTron Super Tuner tunes everything from 160-10 meters. Whether you have balanced line, coax cable, random or long wire, the Super Tuner will match the antenna impedance to your transmitter. All DenTron tuners give you maximum power transfer from your transmitter to your antenna, and isn't that where it really counts?

1 KW MODEL **$129.50** 3 KW MODEL **$229.50**

The Sky Openers

SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one cleverly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and sealed HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	50
80	200
40	entire band

Tuning is easy and reliable. Rugged construction ensures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds.. Handles full legal power limit.

$79.50

EX-1

The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantastic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

$129.50

ALL BAND DOUBLET

This All Band Doublet or inverted Type Antenna covers 160 thru 10 meters. Her total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 450 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

DenTron

DRAKE TVI FILTERS High Pass Filters for TV Sets

provide more than 40 dB attenuation at 52 MHz and lower. Protect the TV set from amateur transmitters 6-160 meters.

Drake TV-300-HP
Model No. 1603
For 300 ohm twin lead
Price: $10.60

DRAKE TV-5200-LP
200 watts to 52 MHz. Ideal for six meters. For operation below six meters, use TV-3300-LP or TV-42-LP.
Model No. 1609 Price: $26.60

Drake TV-75-HP
Model No. 1610
For 75 ohm TV coaxial cable; TV type connectors installed
Price: $13.25

DRAKE TV-3300-LP
1000 watts max. below 30 MHz. Attenuation better than 80 dB above 41 MHz. Helps TV i-f interference, as well as TV front-end problems. Price: $26.60 Model No. 1608

LOW PASS FILTERS FOR TRANSMITTERS

have four pi sections for sharp cut off below channel 2, and to attenuate transmitter harmonics falling in any TV channel and fm band. 52 ohm. SO-239 connectors built in.

DRAKE TV-42-LP Model No. 1605
is a four section filter designed with 43.2 MHz cut-off and extremely high attenuation in all TV channels for transmitters operating at 30 MHz and lower. Rated 100 watts input. Price: $14.60

TUFTS RADIO CATALOG TUFTS RADIO

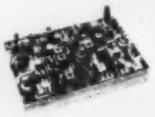
TUFTS RADIO CATALOG TUFTS RADIO

WORK ALL REPEATERS WITH OUR NEW SYNTHESIZER II

The Synthesizer II is a two meter frequency synthesizer. Frequency is adjustable in 5 kHz steps from 140.00 MHz to 149.995 MHz with its digital readout thumb wheel switching. Transmit offsets are digitally programmed on a diode matrix, and can range from 10 kHz to 10 MHz. No additional components are necessary!
Kit . . . . . $169.95 Wired and tested $239.95

RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter	$ 59.95
RX28C W/T . .	same as above–wired & tested . .	104.95
RX50C Kit . .	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX50C W/T .	same as above–wired & tested . .	104.95
RX144C Kit .	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T .	same as above–wired & tested . .	114.95
RX220C Kit . .	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T .	same as above–wired & tested . .	114.95
RX432C Kit . .	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RX432C W/T .	same as above–wired & tested . .	124.95
TX50	transmitter exciter, 1 watt, 6 mtr .	39.95
TX50 W/T . . .	same as above–wired & tested . .	59.95
TX144B Kit . .	transmitter exciter–1 watt–2 mtrs	29.95
TX144B W/T .	same as above–wired & tested. . .	49.95
TX220B Kit . .	transmitter exciter–1watt–220 MHz	29.95
PA2501H Kit .	2 mtr power amp–kit 1w in–25w out with solid state switching, case, connectors	59.95
PA2501H W/T.	same as above–wired & tested . .	74.95
PA4010H Kit .	2 mtr power amp–10w in–40w out–relay switching	59.95
PA4010H W/T.	same as above–wired & tested . .	74.95
PA50/25 Kit .	6 mtr power amp, 1w in, 25w out, less case, connectors & switching .	49.95
PA50/25 W/T .	same as above, wired & tested . . .	69.95
PA144/15 Kit .	2 mtr power amp–1w in–15w out–less case, connectors and switching	39.95
PA144/25 Kit .	same as PA144/15 kit but 25w . .	49.95
PA220/15 Kit .	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit .	power amp–similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10 W/T	10w in–140w out–2 mtr amp . .	179.95
PA140/30 W/T	30w in–140w out–2 mtr amp . .	159.95
PS15C Kit . . .	15 amp–12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection . .	79.95
PS15C W/T . .	same as above–wired & tested . .	94.95
PS25C Kit . . .	25 amp–12 volt regulated power supply w/case, w/fold-back current limiting and ovp	129.95
PS25C W/T . .	same as above–wired & tested . .	149.95
PS25M Kit. . .	same as PS25C with meters	149.95
PS25M W/T . .	same as above–wired & tested . .	169.95
RPT50 Kit. . .	repeater–6 meter	465.95
RPT50	repeater–6 meter, wired & tested	695.95
RPT144 Kit . .	repeater–2 mtr–15w–complete (less crystals)	465.95
RPT220 Kit . .	repeater–220 MHz–15w–complete (less crystals)	465.95
RPT432 Kit . .	repeater–10 watt–432 MHz (less crystals)	515.95
RPT144 W/T .	repeater–15 watt–2 mtr	695.95
RPT220 W/T .	repeater–15 watt–220 MHz. . . .	695.95
RPT432 W/T .	repeater–10 watt–432 MHz. . . .	749.95
DPLA50	6 mtr close spaced duplexer	575.00
TRX50 Kit . .	Complete 6 mtr FM transceiver kit, 20w out, 10 channel scan with case (less mike and crystals).	249.95
TRX144 Kit .	same as above, but 2 mtr & 15w out	219.95
TRX220 Kit .	same as above except for 220 MHz	219.95
TRX432 Kit .	same as above except 10 watt and 432MHz	254.95
TRC-1	transceiver case only	19.95
TRC-2	transceiver case and accessories . .	39.95
SYN II Kit. . .	2 mtr synthesizer, transmitt offsets programmable from 100 KHz–10 MHz, (Mars offsets with optional adapters)	169.95
SYN II W/T . .	same as above–wired & tested . .	239.95
MO-1 Kit. . . .	Mars/cap offset optional	2.50
TO-1 Kit	18 MHz optional tripler	2.50
HT 144B Kit .	2 mtr, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex .	129.95
NICAD.	battery pack, 12 VDC, ½ amp. . .	29.95
BC12	battery charger for above	5.95
Rubber Duck .	2 mtr, with male BNC connector .	8.95

RECEIVERS



RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50
RF28 Kit . . .	10 mtr RF front end 10.7 MHz out	12.50
RF50 Kit . . .	6 mtr RF front end 10.7 MHz out	12.50
RF144D Kit. .	2 mtr RF front end 10.7 MHz out	17.50
RF220D Kit. .	220 MHz RF front end 10.7 MHz out	17.50
RF432 Kit. . .	432 MHz RF front end 10.7 MHz out	27.50
IF 10.7F Kit .	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit. . .	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TRANSMITTERS

TX220B W/T .	same as above–wired & tested . .	49.95
TX432B Kit . .	transmitter exciter 432 MHz . . .	39.95
TX432B W/T .	same as above–wired & tested . .	59.95
TX150 Kit. . .	300 milliwatt, 2 mtr transmitter .	19.95
TX150 W/T . .	same as above–wired & tested . .	29.95

POWER AMPLIFIERS

Blue Line . . . RF power amp, wired & tested, emission–CW-FM-SSB/AM

Model	Frequency	Power Input	Power Output	
BLB 3/150	45- 55MHz	3W	150W	TBA
BLC 10/70	140-160MHz	10W	70W	139.95
BLC 2/70	140-160MHz	2W	70W	159.95
BLC 10/150	140-160MHz	10W	150W	259.95
BLC 30/150	140-160MHz	30W	150W	239.95
BLD 2/60	220-230MHz	2W	60W	159.95
BLD 10/60	220-230MHz	10W	60W	139.95
BLD 10/120	220-230MHz	10W	120W	259.95
BLE 10/40	420-470MHz	10W	40W	139.95
BLE 2/40	420-470MHz	2W	40W	159.95
BLE 30/80	420-470MHz	30W	80W	259.95
BLE 10/80	420-470MHz	10W	80W	289.95

POWER SUPPLIES

O.V.P.	adds over voltage protection to your power supplies, 15 VDC max. . .	9.95
PS3A Kit . . .	12 volt–power supply regulator card with fold-back current limiting . .	8.95
PS3012 W/T .	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/fold-back current limiting and overvoltage protection	239.95

REPEATERS

DPLA144 . . .	2 mtr, 600 KHz spaced duplexer, wired and tuned to frequency . . .	379.95
DPLA220 . . .	220 MHz duplexer, wired and tuned to frequency	379.95
DPLA432 . . .	rack mount duplexer	319.95
DSC-U	double shielded duplexer cables with PL259 connectors (pr.) . . .	25.00
DSC-N	same as above with type N connectors (pr.)	25.00

TRANSCEIVERS

SYNTHESIZERS

WALKIE-TALKIES

OTHER PRODUCTS BY VHF ENGINEERING

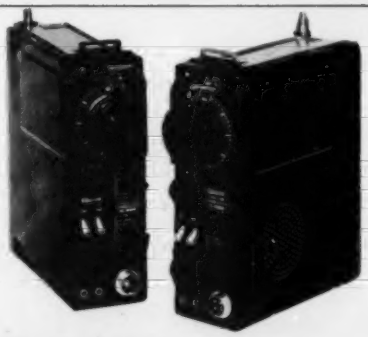
CD1 Kit	10 channel receive xtal deck w/diode switching.	$ 6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD3 Kit	UHF version of CD1 deck, needed for 432 multi-channel operation.	12.95
COR2 Kit . . .	carrier operated relay.	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each) . . .	5.00
CWID Kit . . .	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed .	59.95
MIC 1	2,000 ohm dynamic mike with P.T.T. and coil cord	12.95
TS1 W/T	tone squelch decoder	59.95
TS1 W/T	installed in repeater, including interface accessories	89.95
TD3 Kit	2 tone decoder	29.95
TD3 W/T . . .	same as above–wired & tested .	39.95
HL144 W/T . .	4 pole helical resonator, wired & tested, swept tuned to 144 MHz ban . .	24.95
HL220 W/T . .	same as above tuned to 220 MHz ban	24.95
HL432 W/T . .	same as above tuned to 432 MHz ban	24.95

Vhf engineering
THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

Now It's Crystal Clear

Yes, now ICOM helps you steer clear of all the hassles of channel crystals. The new **IC-225** is the same surprising radio you've come to know and love as the **IC-22A**, except that it is totally crystal independent. **Zero crystals.** Solid state engineering enables you to program 23 channels of your choice without waiting. Now the ICOM performance you've demanded comes with the convenience you've wanted, with your new **IC-22S.**

Price: $299.00



Hold it!

Take hold of SSB with these two low cost twins. ICOM'S new portable **IC-202** and **IC-502** put it within your reach wherever you are. You can take it with you to the hill top, the highways, or the beach. Three portable watts PEP on two meters or six!

Hello, DX! The ICOM quality and excellent receiver characteristics of this pair make bulky converters and low band rigs unnecessary for getting started in SSB-VHF. You just add your linear amp, if you wish, connect to the antenna, and DX! With the **202** you may talk through OSCAR VI and VII! Even transceive with an "up" receiving converter! The **IC-502,** similarly, makes use of six meters in ways that you would have always liked but could never have before. In fact, there are so many things to try, it's like opening a new band.

Take hold of Single Side Band. Take hold of some excitement. Take two.

IC-202
2 Meter SSB • 3 Watts PEP • True IF Noise Blanker Switched Dial Lights • Internal Batteries • 2000KHz VXO Tuning • 144.0, 144.2 + 2 More! • FET
Price: $259.00

IC-502
6 Meter SSB • 3 Watts PEP • True IF Noise Blanker Switched Dial Lights • Internal Batteries • 800KHz VFO • FET
Price: $249.00

IC-245 Transceiver
The VFO Revolution goes mobile with the unique, ICOM developed LSI synthesizer with 4 digit LED readout. The IC-245 offers the most for mobile on the market. The easy to use tuning knob moves accurately over 50 detent steps and assures excellent control as easily as steering the vehicle. With its optional adapter, the IC-245 puts you into all mode operation on 12V DC power with a compact dash-mounted transceiver. In FM, the synthesizer command frequency is displayed in 5 kHz steps from 146 to 148 MHz, and with the side band adapter the step rate drops to 100 Hz from 144 to 146 MHz. For maximum repeater flexibility, the transmit and receive frequencies are independently programmable on any separation. The IC-245 even comes equipped with a multiple pin Molex connector for remote control. The IC-245 is a product of the revolution in VFO design, from its new style front panel, to its excellent mechanical rigidity and Large Scale Integrated Circuitry. Your IC-245 will give you the most for mobile. $499.00

THE NEW ICOM 4 MEG, MULTI-MODE, 2 METER RADIO – IC 211
ICOM introduces the first of a great new wave of amateur radios, with new styling, new versatility, new integration of functions. You've never before laid eyes on a radio like the IC-211, but you'll recognize what you've got when you first turn the single-knob frequency control on this compact new model. The IC-211 is fully synthesized in 100 Hz or 5 kHz steps, with dual tracking, optically coupled VFOs displayed by seven-segment LED readouts, providing any split. The IC-211 rolls through 4 megahertz as easily as a breaker through the surf. With its unique ICOM developed LSI synthesizer, the IC-211 is now the best "do everything" radio for 2 meters, with FM, USB, LSB and CW operation. $749.00

Now ICOM Introduces 15 Channels of FM to Go!

The New IC-215: the FM Grabber

This is ICOM's first FM portable, and it puts good times on the go. Change vehicles, walk through the park, climb a hill, and ICOM quality FM communications go right along with you. Long lasting internal batteries make portable FM really portable, while accessible features make conversion to external power and antenna fast and easy.

Grab for flexibility with the new **IC-215** FM portable.

- Front mounted controls and top mounted antenna
- Narrow filter (15KHz — compatible spacing)
- 15 channels (12 on dual / 3 priority)
- Fully collapsible antenna
- Compatible mount feature for flexible antenna
- Dual power (3 watts high / 400 mw low, nominal)
- External power and antenna easily accessible
- Lighted dial and meter

Price: $229.00

Your new **IC-215** comes supplied with 5 popular channels, handheld rate, with protective case, shoulder strap, connectors for external power and speaker, 9 long life C batteries.

ICOM

TUFTS RADIO CATALOG TUFTS RADIO

model 333
dummy load
wattmeter

Favorite Lightweight Portable—250 WATT RATING—Air Cooled

Ideal field service unit for mobile 2-way radio—CB, marine, business band. Best for QRP amateur use, CB, with zero to 5 watts full scale low power range.

• specifications

Frequency Range	DC to 300 MHz
VSWR	Less than 1.3:1 to 230 MHz
Power Range	250 watts intermittent
Wattmeter Ranges	0–5, 0–50, 0–125, 0–250
Connector	SO-239
Size	4" x 7" x 6"
Shipping Weight	2 lbs.
Price	$90.50

...model 374 dummy load wattmeter...

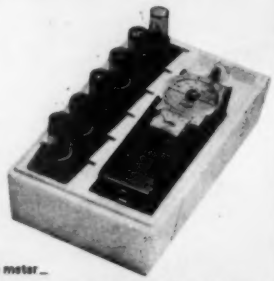
Top of the Line—1500 WATT RATING—Oil Cooled

Our highest power combination unit. Rated to 1500 watts input (intermittent). Meter ranges are individually calibrated for highest accuracy.

• specifications

Frequency Range	DC to 300 MHz
VSWR	Less than 1.3:1 to 230 MHz
Power Range	1500 watts DC intermittent. Warning light* signals maximum heat limit.
Wattmeter Ranges	0–15, 0–50, 0–300, 0–1500
Input Connector	SO-239 (hermetically sealed)
Size	4-3/4" x 9" x 10-1/4"
Shipping Weight	12 lbs.
Price	$215.00

LITTLE DIPPER



model 331A
transistor dip meter...

Portable RF single generator, signal monitor, or absorption wavemeter. Lightweight (1 pound, 6 ounces with all coils), battery-powered unit is ideal for field use in testing transceivers, tuning antennas, etc. Can also be used to measure capacity, inductance, circuit Q, and other factors. Indispensable for experimenters, it is easily the most versatile instrument in the shop. Continuous coverage from 2 MHz to 230 MHz in seven ranges.

Unit consists of a transistorized RF dip oscillator and 100-microampere meter circuit. Meter circuit uses a single-transistor DC amplifier with a potentiometer in the emitter circuit to control meter sensitivity. A 3-position slide switch connects the meter circuit to the oscillator for dip measurements, to a diode for absorption wavemeter peak measurements, or provides audio modulation of the RF signal.

Frequency dial has a calibrated reference point for Q and bandwidth measurements. Each coil has its own frequency dial: there's no confusion with multiple markings or small, hard-to-read scales near the center of the dial.

• specifications

Frequency Coverage	2 MHz to 230 MHz in 7 overlapping ranges by plug-in coil assemblies: 2 MHz–4 MHz, 4 MHz–8 MHz, 8 MHz–16 MHz, 16 MHz–32 MHz, 32 MHz–64 MHz, 50 MHz–110 MHz, 110 MHz–230 MHz
Accuracy	±3%
Modulation	1000 Hz, 25% to 40%
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	7" x 2-1/4" x 2-1/2"
Shipping Weight	1 lb., 6 oz.
Price	$120.00

B&W BARKER & WILLIAMSON, INC.

Economy High Power Load—1500 WATT RATING—Oil Cooled
model 384 dummy load

For high power when all you need is the load.

• specifications

Frequency Range	DC to 300 MHz
VSWR	Less than 1.3:1 to 230 MHz
Power Range	1500 watts intermittent. Warning light* signals maximum heat limit.
Connector	SO-239 (hermetically sealed)
Size	4-3/4" x 9" x 10-1/2"
Shipping Weight	12 lbs.
Price	$94.50

High Power—1000 WATT RATING—Oil Cooled
...model 334A dummy load wattmeter.

Our most popular combination unit. Handles full amateur power. Meter ranges individually calibrated. Can be panel mounted.

• specifications

Frequency Range	DC to 300 MHz
VSWR	Less than 1.3:1 to 230 MHz
Power Range	1000 watts CW intermittent. Warning light* signals maximum heat limit.
Wattmeter Ranges	0–10, 0–100, 0–300, 0–1000
Input Connector	SO-239 (hermetically sealed)
Size	4-3/4" x 9" x 10-1/4"
Shipping Weight	12 lbs.
Price	$174.00

WIDE RANGE ATTENUATOR

Model 371-1

Protect your receiver or converter from overload, or provide step attenuation of low-level RF signals from signal generators, preamplifiers, or converters. Seven rocker switches provide attentuation from 1 dB to 61 dB in 1-dB steps. Switches are marked in dB, 1-2-3-5-10-20-20. Sum of actuated switches (IN position) gives attenuation. With all switches in OUT position, there is NO insertion loss. Attenuator installs in coaxial line using UHF connectors.

• specifications

Power Capacity	1/4 watt
VSWR	1.3:1 maximum, DC to 225 MHz
Impedance	50 ohms
Accuracy	1 dB/dB, DC to 60 MHZ 0.1 dB/dB ±0.5 dB, DC to 160 MHz 0.1 dB/dB ±1.0 dB, DC to 225 MHz
Size	8-1/2" x 2-1/2" x 2-1/4"
Shipping Weight	1-1/2 lbs.
Price	$49.50

-C – LINE AMATEUR EQUIPMENT — DRAKE — COMMUNICATIONS RECEIVERS-

Drake R-4C

Solid State Linear permeability-tuned VFO with 1 kHz dial divisions. Gear driven dual circular dials. High mechanical, electrical and temperature stability.

Covers ham bands with crystals furnished. Covers all of 80, 40, 20 and 15 meters, and 28.5-29.0 MHz of 10 meters.

Covers 160 meters with accessory crystal. In addition to the ham bands, tunes any fifteen 500 kHz ranges between 1.5 and 30 MHz. 5.0 to 6.0 MHz not recommended. Can be used for MARS, WWV, CB, Marine and Shortwave broadcasts.

Superior selectivity: 2.4 kHz 8-pole filter provided in ssb positions. 8.0 kHz, 6 pole selectivity for a-m. Optional 8-pole filters of .25, .5, 1.5 and 6.0 kHz bandwidths available.

Tunable notch filter attenuates carriers within passband.

Smooth and precise passband tuning.

Transceive capability: may be used to transceive with the T-4X, T-4XB or T-4XC Transmitters. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Agc with fast attack and two release times for ssb and a-m or fast release for break-in cw. Agc also may be switched off.

New high efficiency accessory noise blanker that operates in all modes.

Crystal lattice filter in first i-f prevents cross-modulation and desensitization due to strong adjacent channel signals.

Excellent overload and intermodulation characteristics.

25 kHz Calibrator permits working closer to band edges and segments.

Scratch resistant epoxy paint finish.

Price: $599.00

Drake T-4XC

Solid State Linear permeability-tuned VFO with 1 kHz dial divisions. Gear driven dual circular dials. High mechanical, electrical and temperature stability.

Covers ham bands with crystals furnished. Covers all of 80, 40, 20 and 15 meters, and 28.5-29.0 MHz of 10 meters.

Covers 160 meters with accessory crystal. Four 500 kHz ranges in addition to the ham bands plus one fixed-frequency range can be switch-selected from the front panel.

Two 8-pole crystal lattice filters for sideband selection.

Transceives with the R-4, R-4A, R-4B, R-4C and SPR-4 Receivers. Switch on the T-4XC selects frequency control by receiver or transmitter PTO or independently. Illuminated dial shows which PTO is in use.

Usb, lsb, a-m and cw on all bands.

Controlled-carrier modulation for a-m is compatible with ssb linear amplifiers.

Automatic transmit-receive switching. Separate VOX time-delay adjustments for phone and cw. VOX gain is independent of microphone gain.

Choice of VOX or PTT. VOX can be disabled by front panel switch.

Adjustable pi network output.

Transmitting agc prevents flat-topping.

Meter reads relative output or plate current with switch on load control.

Built-in cw sidetone.

Spotting function for easy zero-beating.

Easily adaptable to RTTY, either fsk or afsk.

Compact size; rugged construction. Scratch resistant epoxy paint finish.

Price: $599.00

Drake SPR-4 – $629.00

- **Programmable to meet specific requirements: SWL, Amateur, Laboratory, Broadcast, Marine Radio, etc.**
- **Direct frequency dialing: 150-500 kHz plus any 23 500 kHz ranges, 0.5 to 30 MHz**
- **FET circuitry, all solid state**
- **Linear dial, 1 kHz readout**
- **Band-widths for cw, ssb, a-m with built-in LC filter**
- **Crystals supplied for LW, seven SW, and bc bands**
- **Notch filter**
- **Built-in speaker**

Drake DSR-2 – $2950.00

- **Continuous Coverage 10 kHz to 30 MHz**
- **Digital Synthesizer Frequency Control**
- **Frequency Displayed to 100 Hz**
- **All Solid State**
- **A-m, Ssb, Cw, RTTY, lsb**
- **Series Balanced Gate Noise Blanker**
- **Front End Protection**
- **Optional Features Available on Special Order**

Drake FS-4 Digital Synthesizer – $250.00

The new solid state Drake FS-4 Synthesizer opens the door to a new world of continuous-tuning short wave! Combines synthesized general coverage flexibility with the selectivity, stability, frequency readout and reliability of the Drake R-4C or SPR-4 Receivers.

• Interfaces with all R-4 series receivers and T-4X series transmitters: (R-4, R-4A, R-4B, R-4C, SPR-4, T-4, T-4X, T-4XB and T-4XC), without modification. • MHz range is set on FS-4, with kHz readout taken from receiver dial. • Complete general coverage—no range crystals to buy. • T-4/T-4X series transmitters transceive on any FS-4 frequency, when used with R-4 series receivers. • Readout 1 kHz with Drake PTO.

Price: $250.00

Power Supplies

Power Supplies for T-4, T-4X, T-4XB or T-4XC (The AC-4 can be housed in an MS-4 speaker cabinet).

Model No. 1501 Drake AC-4 $120.00
Model No. 1505 Drake DC-4 $135.00

Drake MS-4

Drake MS-4 Matching Speaker for use with R-4, R-4A, R-4B and R-4C Receivers. (Has space to house AC-3 and AC-4 Power Supplies) **Price: $24.95**

Accessories

DRAKE MICROPHONES

Wired for use with Drake transmitters and transceivers, for either push-to-talk or VOX. Type of operation is determined by the VOX control setting of the transmitter.

Desk Type Model No. 7075

• **Type:** Heavy Duty Ceramic Desk Top • **Cable:** Four Foot, 3-Conductor, One Shield • **Output Level:** Minus 54 dB (0 dB = 1 volt/microbar) • **Frequency Response:** 80-7000 Hz • **Switching:** Adapts to either push-to-talk or VOX. **Price: $39.00**

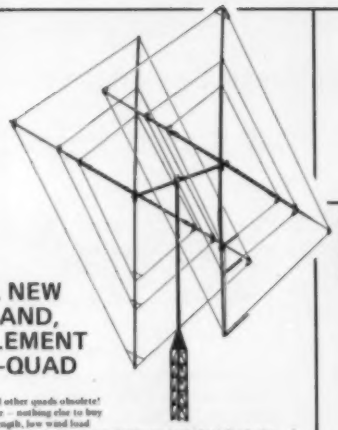
Hand-Held Type Model No. 7072

• **Type:** Ceramic, hand held • **Cable:** 11" Retracted, 5' extended, PVC 3 Cord, 1 shielded, Coil Cord • **Case:** Cycolac • **Finish:** Grey • **Output Level:** Minus 65 dB (0 dB = 1 volt/microbar) • **Frequency Response:** 300-3000 Hz • **Switching:** Adapts to either push-to-talk or VOX.

Price: $19.00

TUFTS RADIO CATALOG TUFTS RADIO

TUFTS RADIO CATALOG TUFTS RADIO



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- Makes all other quads obsolete!
- Complete – nothing else to buy
- High strength, low wind load

The Hy-Quad from Hy-Gain makes all other quads obsolete! Here's why:
First, it's the only quad that is complete. There is nothing more to shop for or buy.
Secondly, it is uniquely designed so that it overcomes all of the previously undesirable features inherent in quads.
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Hy-Gain's all new Hy-Quad will outdo all other quads because it's engineered to do just that. The Hy-Quad is new, it's superior, it's complete. It's the first quad to have everything: spreaders are broken up at strategic electrical points with Cyclolac insulators / tri-band 2 element construction with individually resonated elements with no interaction / Hy-Quad requires only one feed line for all three bands / individually tuned gamma matches on each band with Hy-Gain exclusive vertex feed / full wave element loops require no tuning stubs, traps, loading coils or baluns / heavy duty mechanical construction of strong swaged aluminum tubing and die formed spreader-to-boom clamps / extra heavy duty universal boom-to-mast clamp that tilts and mounts on any mast 1½" to 2½" in diameter / aluminum stranded wire. You can open and close the bands with this antenna. You'll experience the thrill of real DX.

Order No. 244 Price: $219.95

SPECIFICATIONS

Overall length of spreaders	25'5"	Forward gain	8.5 db
Turning radius	13'6"	Input impedance	52 ohms
Weight	42 lbs.	VSWR	1.2:1 or
Boom diameter	2"		better at resonance on all bands
Boom length	8'	Power	Maximum
Mast diameter	1¼" to 2½"		legal
Wind survival	100 mph	Front-to-back ratio	25-35 db
Surface area	6.4 sq. ft.		depending upon electrical height
Wind load at 100 mph	256.0 lbs.	Polarization	Horizontal

The Versatile Model 18V for 80 thru 10 Meters

The Model 18V is a low-cost, highly efficient vertical antenna that can be tuned to any band 80 thru 10 meters by a simple adjustment of the feed point on the matching base inductor. Fed with 52 ohm coax, this 18 ft. radiator is amazingly efficient for DX or local contact. Constructed of heavy gauge aluminum tubing, the Model 18V may be installed on a short 1¾ inch mast driven into the ground. It is also adaptable to roof or tower mounting. Highly portable, the Model 18V can be quickly knocked down to an overall length of 5 ft. and easily re-assembled for field days and camping trips. Shpg. Wt., 5 lbs.

Order No. 193 Price: $33.00

WIDE BAND VERTICAL for 80 - 10 Meters Hy-Gain's 18 AVT/WB

Take the wide band, omni-directional performance of Hy-Gain's famous 14AVQ/WB, add 80 meter capability plus extra-heavy duty construction – and you have the unrivalled new 18AVT/WB. In other words, you have quite an antenna.

- Automatic switching, five band capability is accomplished through the use of three beefed-up Hy-Q traps (featuring large diameter coils that develop an exceptionally favorable L/C ratio).
- Top loading coil.
- Across-the-band performance with just one furnished setting for each band (10 through 40).
- True 1/4 wave resonance on all bands.
- SWR of 2:1 or less at band edges.
- Radiation pattern has an outstandingly low angle whether roof top or ground mounted.

CONSTRUCTION . . . of extra-heavy duty tapered swaged seamless aluminum tubing with full circumference, corrosion resistant compression clamps at slotted tubing joints . . . is so rugged and rigid that, although the antenna is 25' in height, it can be mounted without guy wires, using a 12" double grip mast bracket, with recessed coax connecter.

Order No. 386 Price: $97.00

hy-gain

For 10, 15, and 20 Meters
New Hy-Gain Model 12 AVQ

Completely self-supporting, the Model 12AVQ features Hy-Q traps...12" double-grip mast bracket...taper swaged seamless aluminum construction with full circumference compression clamps at tubing joints. It delivers outstanding low angle radiation. SWR is 2:1 or less on all bands. Overall height is 13'6". Shipping weight 7.2 lbs. Price: $47.00

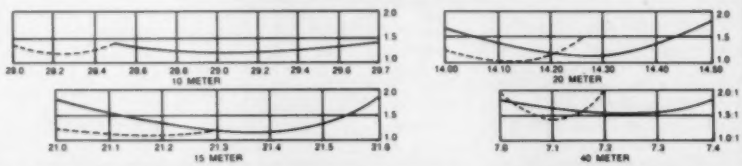
Order No. 384

New, improved successor to the world's most popular vertical!
Hy-Gain Model 14 AVQ/WB for 40-10 Meters.
● Wide band performance with one setting (optimum settings for top performance furnished) ● New Hy-Q Traps ● New 12" Double-Grip Mast Bracket ● Taper Swagged Seamless Aluminum Construction

The Model 14AVQ/WB, new improved successor to the world famous Model 14AVQ, is a self-supporting, automatic band switching vertical that delivers omni-directional performance on 40 through 10 meters. Three separate Hy-Q traps featuring large diameter coils that develop an exceptionally favorable L/C ratio and a very high Q, provide peak performance by effectively isolating sections of the antenna so that a true 1/4 wave resonance exists on all bands. Outstandingly low angle radiation pattern makes DX and other long haul contacts easy. Superior mechanical features include solid aluminum housing for traps using air dielectric capacitor...heavy gauge taper swaged seamless aluminum radiator...full circumference compression clamps at tubing joints that are resistant to corrosion and wear...and a 12" double-grip mast bracket that insures maximum rigidity whether roof-top or ground mounted. The Model 14AVQ/WB also delivers excellent performance on 80 meters using Hy-Gain Model LC-80Q Loading Coil. Overall height is 18 feet. Shipping weight 9.2 lbs. Unsurpassed portability...outstanding for permanent installations. Price: $67.00

Order No. 385

TYPICAL 14AVQ/WB VSWR CURVES



ROOF MOUNTING KIT – Model 14RMQ provides rugged support for Model 14AVQ/WB.
Order No. 184 Price: $24.95

Hy-Gain REEL TAPE PORTABLE DIPOLE for 10 thru 80 Meters Model 18TD

The most portable high performance dipole ever...

The Model 18TD is unquestionably the most foolproof high performance portable doublet antenna system ever developed. It has proven invaluable in providing reliable communications in vital military and commercial-applications throughout the world. Two stainless steel tapes, calibrated in meters, extend from either side of the main housing up to a total distance of 132 feet for 3.5 mc operation. 25 ft. lengths of polypropylene rope attached to each tape permits installation to poles, trees, buildings...whatever is available for forming a doublet antenna system. Integrated in the high impact housing is a frequency to length conversion chart calibrated to meter measurements on the tapes...makes installation foolproof. Feeds with 52 ohm coax. Delivers outstanding performance as a portable or permanent installation. Measures 10x5¾x2 inches retracted. Wt., 4.1 lbs.

Order No. 228 Price: $94.95

DenTron MLA-2500 $799.50

DenTron Radio has packed all the features a linear amplifier should have into their new MLA-2500. Any Ham who works it can tell you the MLA-2500 really was built to make amateur radio more fun.

- ALC circuit to prevent overloading
- 160 thru 10 meters
- 1000 watts DC input on CW, RTTY or SSTV Continuous Duty
- Variable forced air cooling system
- Self-contained continuous duty power supply
- Two EIMAC 8875 external anode ceramic/metal triodes operating in grounded grid
- Covers MARS frequencies without modifications
- 50 ohm input and output impedance
- Built-in RF wattmeter
- 117V or 234V AC 50-60 hz
- Third order distortion down at least 30 db
- Frequency range:
  1.8MHz (1.8-2.5) 3.5MHz (3.4-4.6)
  7MHz (6.0-9.0) 14MHz (11.0-16.0)
  21MHz (16.0-22.0) 28MHz (28.0-30.0)
- 40 watts drive for 1 KW DC input
- Rack mounting kit available (19" rack)
- Size: 5½" H x 14" W x 14" D Wt. 47 lbs.

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MIL. SPEC. COMPONENTS ● NO RFI ● SELF CONTAINED
XTAL CONTROLLED ● LEVEL ADJUSTABLE FROM FRONT

Pat. Pend.

PP-1

PP-2

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J2

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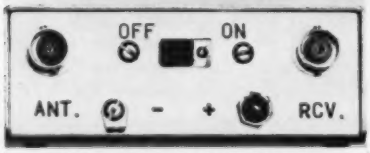

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- Dual-gate MOSFET r.f. stage with diode protected input.
- Dual-gate MOSFET mixer for minimum cross modulation. Every converter tested for noise figure (2.5 — 3.0 dB max.) with Hewlett Packard noise measuring equipment.
- 6 tuned circuits.
- More than 20 dB gain. .1 microvolt sensitivity guarantee when used with receivers having 1 microvolt or better sensitivity.
- Complete with one .005% plug-in crystal to cover 144-146 or 146-148 MHz (be sure to specify which, or get both for only $6.00 more). Standard output is for 28-30 MHz.
- 16 gauge aluminum case with BNC receptacles and antenna/power switch. Measures 3½" x 2¾" x 1¼"

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• An add-on unit, no internal connections or adjustments required to associated equipment • Standard Amplifier Models operate FM. Linear Models operate all modes: SSB, FM, AM, RTTY, CW, etc. • "Microstrip" design provides high stability and optimum performance over wide bandwidth • Factory adjusted, no tuning required. • Mobile mounting bracket included • RF sensing T/R switching, adjustable dropout delay • Remote keying capability • Thermally coupled biasing • Reverse Voltage protected and fused • Conservatively rated with oversized heat sink • Red LED indicators for monitoring DC and RF • Ninety day material and workmanship warranty

MODEL NO.	INPUT POWER (watts)	NOM OUTPUT (watts)	NOM CURRENT 13.8 VDC	PRICE
2M 3X30	1-4	30	4	$72.95
2M 3X30L*	1-4	30	4	$82.95
2M 10X40	2-12	40	5	$77.95
2M 15X50L*	5-15	50	6	$94.95
2M 15X80	5-15	80	11	$129.95
2M 15X80L*	5-15	80	11	$139.95

NOTES: *Linear; AM, CW, FM, SSB, RTTY
size: 4 1/8 X 5 1/2 X 2 5/8
technical specifications and data subject to change without notice

Dealership inquiries are invited

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Digital Bargain Hunting

- - tips on surplus computer goodies

Louis S. Macknik W8KBC
45A Scott Circle
Bedford MA 01730

The computer hobbyist hardware market has been moving very rapidly, with new products being introduced nearly every day. If you are like me, you want to have most of them, too! No budget can stretch that far, if at all. Balancing the endless list of necessary peripherals against a dwindling level in your checkbook is a lot easier to do if you can take advantage of the used electronics market. I would love to have one of those new $900 dumb terminals, but in many ways it makes more sense to shop for a $300 used one, repair it if necessary, modify it to be just as dumb, and put the remaining $600 (?) into more memory, a disk, or good software.

Photo 1. The RCA 70/752 Video Data Terminal has a hidden door to the right of the screen concealing controls for the display and alignment of the character generator. The keyboard can be moved up to one foot away from the display.

Rest assured, a surplus computer equipment world does exist. My impression is that it is merging with the surplus market that hams have ravaged for years, just as ham radio and the computer hobby seem to be merging. To introduce you to what may be available surplus, I'll give you a few suggestions to get started, and then describe one of my more profitable adventures.

Preparation

First, you must convince yourself that digital equipment is not forbidden fruit into which you must not byte. I am reminded of the ham home brew enthusiast who for years builds test equipment, antennas, and transmitters of unending complexity, yet never touches his receiver or builds one because *a receiver is too tough to handle!* If you have an electronics hardware background, you have a head start and should not be intimidated. If you are a software expert trying to assemble your own system for the first time, there are a lot of people in computer clubs, ham clubs, and elsewhere who can help you. In any case, the best way to gain an appreciation for a new discipline, hardware or software, is to get your hands not only on it, but into it as well.

The second thing you must do is use common sense to gain an eye for the bargain. I've been burned a few times and went home with nothing more than a fancy boat anchor, but never for any great sum of money. After all, the higher the price, the more careful you automatically become. This field is moving so rapidly that a piece of gear which creates nausea in a state of the art hobbyist

could very well be only two or three years old and provide a lifetime of service at a fraction of the original cost. Look for equipment being offered with spare parts, or gear which uses the type of components you've seen advertised in the back pages of magazines. You should also look at each item with an alternative project in mind just in case you do goof (*caveat emptor*). For example, you buy a floating point box to do hardware arithmetic and then discover that it was the victim of a slight overvoltage. The box or card rack it came in is probably worth the cost and can be used later (I know, I can't get *my* car in the garage, either). An operations or maintenance manual sold with the equipment can be worth its weight in gold, but don't be fanatical about it. Many times you can reconstruct all you need to know by studying the equipment itself. After all, one goal of most hobbyists is to replace hard cash with personal time spent pursuing the hobby.

You should also know the market if you are to take advantage of it. Find out where the surplus houses are, what their specialty seems to be, and get on the mailing list for any flyers. Have a general knowledge of what a bargain price is so that you can make an intelligent decision when you come across that 400 pound transformer you desperately need to beef up your power supply. Read the ads in the back pages of magazines and have a feel for the current prices on used or surplus prime components.

Interested? Well, let me use one of my experiences to illustrate and at the same time describe one of the bargains available. For those of you who would like to have a used CRT terminal, but are not sure such things can be used by hobbyists, the following is a description of the RCA 70/752 Video Data Terminal, shown in Photo 1, and how I put it to use. For those of you who recognized it as a bargain and have one in your garage, drag it out, because the modifications I'll describe can be completed in minutes.

The Bargain

One day while watching my home brew 8008 system blink its LEDs magically, the mail brought me a flyer advertising the RCA 70/752 VDT (Video Data Terminal) with spare parts for $200. Smelling a bargain, I rushed to the store to examine it. It was a complete terminal with a 12-inch display of 20 lines of 54 characters (1080 total) and a detachable matching keyboard. It used a 1200 baud RS-232 interface and had internal memory. The keyboard was mechanical (IBM style) but was missing parts. The keyboard enclosure had extra function keys for cursor control and for *editing*, including single character erase, single line erase, full screen erase, and a mode for inserting data such as letters left out of words. There seemed to be many circuit boards inside with discrete components that had easily identifiable markings (2N3904, .01 uF, etc.). That was important, because it told me that replacement parts for those boards would not be hard to find, and the type numbers indicated that the equipment was not very old. A card rack holding up to six cards was found inside the rear cover, but two cards were missing. That could present a problem, I thought, because the cards that were there had up to 48 ICs on them and none of the ICs had recognizable numbers. There were two muffin fans, a sturdy cabinet, and a healthy looking power supply. The spare parts turned out to be an extra matching cabinet (for a vector graphics display later??), a spare CRT and yoke (new), most of the power supply parts, and several spare boards (non-logic). A quality control tag inside the cabinet indicated assembly only three years previously! Encouraged, I dragged the thing to an ac

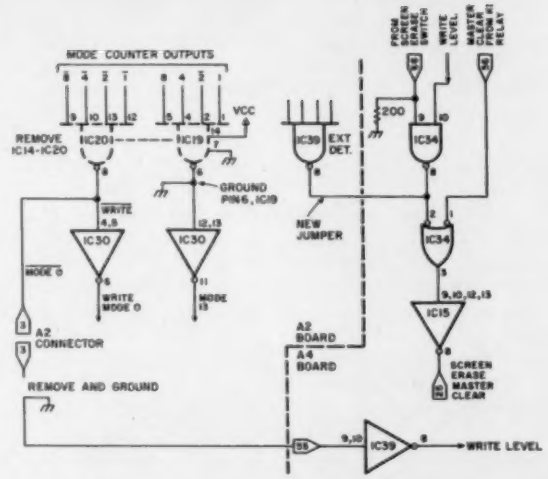


Fig. 1. Summary of modifications. Circuits for mode decoding and Screen Erase are shown before and after changes.

Photo 2. The mechanical keyboard was replaced by an electronic keyboard. The cursor and editing controls are on the right side of the control console.

outlet, plugged it in, and, with fear in the salesman's eyes, turned it on. After what seemed like hours, 1080 characters appeared on the screen ... all garbage ... but did light up and draw current, so I bought it.

During the following weeks, I must have disassembled and reassembled the thing four or five times, trying to uncover its secrets. I learned that it used a monoscope for character generation (*good grief!*). Imagine using a second special CRT to generate character video when a handful of ICs will do the same job! It also employed a magneto-strictive delay line memory (definitely not Altair bus compatible), which was no more than a long wire coiled up in a box. I had visions of trying to load it up on 80 meters as a compact antenna for my ham activities! The keyboard generated a 64 character ASCII subset with special characters for multiply (x), divide (÷), and ETX (end of text). It looked great but wouldn't work with two of the boards missing and the motor gone from the keyboard. I recognized my lack of mechanical aptitude and scrapped the old keyboard, building an electronic one to replace it. I used a keyboard that is widely advertised for around $20 and a KR-2376 keyboard ROM (see Photo 2). Since I didn't know which family of ICs I was dealing with in the terminal, I buffered the keyboard ROM with TTL, hooked it to the terminal, and applied the standard tests. No smoke, voltage levels okay, but no other response. After talking it up with many people, I located someone who had a 752 VDT working and borrowed his logic boards. It worked to some extent, but the characters were badly distorted. After replacing the video driver board with the new one from my spare parts, it worked perfectly!

I soon learned that the VDT operated only in the Screen Read mode. That is, the operator creates a message by pushing the Write key and typing the desired data. The ETX key must be the last character typed in. Editing can be done, as if off-line, using the editing keys I mentioned earlier. When finished, the XMT key must be pushed to transmit the data to the computer. Everything on the screen is transmitted, up to and including the ETX character. The VDT automatically inserts an STX (start of text) character at the beginning of the transmission. When transmission at 1200 baud is completed, the VDT switches to the receive mode, with the keyboard and function keys disabled. The computer may then reply, but must bracket its message between the STX and ETX characters also. When the VDT receives the ETX, it reverts to the Write mode, with the computer's reply on the screen and everything else erased.

At this point I was reasonably happy. After all, the only thing left to do was find my own logic boards to replace the ones I had borrowed and must return. I had considered the insane idea of duplicating the boards, but double-sided boards are tough enough without considering four layered boards (as these were). However, I reasoned, if I could decipher the logic family, I could simply wire-wrap the two boards I needed. After several iterations of sort and compare, I almost settled on DTL as the probable family. Vcc appeared always on pin 14 and ground on pin 7 (could be TTL). Vcc was set at +4.5 volts, a little low for TTL. Then, while trying to repair a bad connection I had created, I noticed that someone had mercifully installed an MC851P one-shot on the A21 filter board. DTL it is! To make a long story shorter, I succeeded in wire-wrapping the two boards using Motorola MC830/930 or equivalent ICs. The new boards just fit in the rack after trimming the wire-wrap pins on the sockets. My bargain terminal was working on its own for an investment of $250 and a lot of my time.

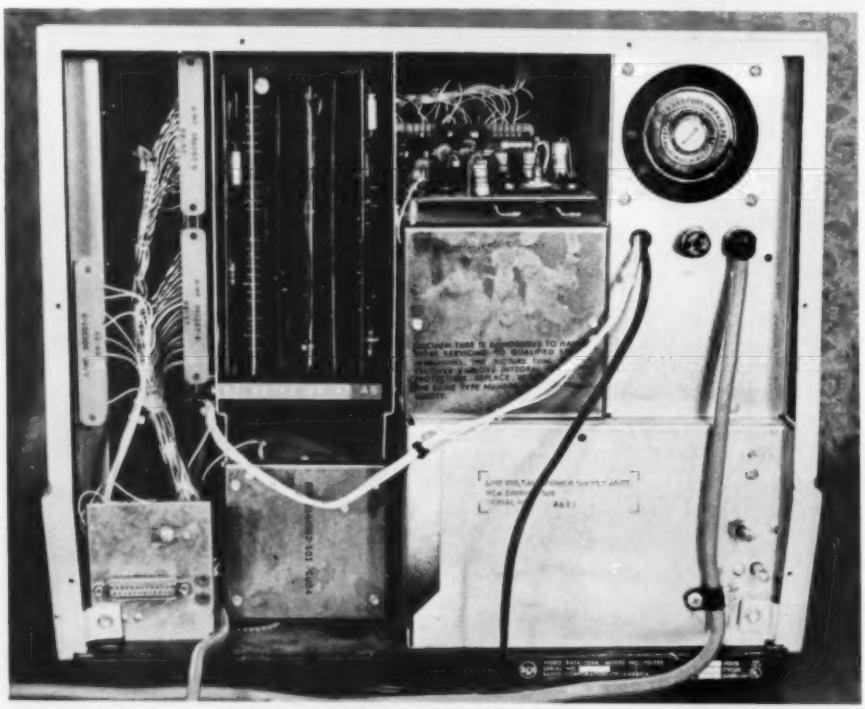


Photo 3. Rear view of the Video Data Terminal showing the logic card rack, RS-232 connector, and memory on the left. Power supply with integral fan is on the right.

Compatibility

Or was it? Yes, in part, but a working component does not make a working system. Having all data bracketed by STX and ETX became a sore point for me. Many of my programs required three characters from the VDT (STX, desired character, ETX). Also, the VDT always seemed to be in the wrong mode. There were two possible solutions to this problem: software adaptation or hardware modification. Software adaptation is cheaper for the hobbyist, so I tried that first. My input routine was written to grab at least two characters from the VDT before returning to the calling program, each time checking to see if an ETX had been received. If it was received, the program sent an STX to the terminal to put it into the receive mode. If ETX had not yet been received, more data was forthcoming from the ter-

minal. I found it best to never send ETX to the VDT, since that would switch it to the Write mode, and the possibility of losing the next computer output was very real. This scheme works very well and served me for some time. At least two weeks or more.

Not willing to leave well enough alone, I favored a hardware modification to the 752 to allow full duplex operation without having to deal with the STX and ETX characters. The criteria were that the VDT should always be ready to receive at 1200 baud, the cursor controls should always be enabled, the keyboard should provide parallel data directly to the computer, and there should be no requirement for the program to echo the keyboard to the display. In addition, I wanted the Screen Erase and Cursor Home functions to be under software control. It sounded like quite a task, but turned out to be a very simple modification.

Modifications

The logic cards are numbered A1 through A6 from left to right when facing the rear of the cabinet (see Photo 3). Remove A2, second from the left, and position it with the component side up and the edge connector to the right. Number the IC positions starting at the upper left. Positions with no ICs inserted are also numbered. You should end up with the ICs along the edge connector numbered as 4, 8, 12, etc., from top to bottom (see Photo 4). Now carefully remove IC14, IC15, IC16, IC17, IC18, IC19, and IC20. I found a solder sucker to be valuable here. If you too have wire-wrapped boards, simply unplug the ICs. These ICs decode which mode the terminal is in, and with them removed, it is in no mode at all. Next, solder a jumper wire between the holes where IC19 pin 6 and IC19 pin 7 were inserted. This grounds the $\overline{\text{Mode 13}}$ line and puts the terminal in the basic receive mode. You are done if you don't care about the other criteria I established. To enable the cursor controls and allow for direct keyboard entry to the display, remove the wire-wrap wire from pin 3 of the A2 connector (on the chassis) and connect it to ground. This modification enables the Write mode (with the Receive mode still active). Parallel data is taken directly from the keyboard, or from where the keyboard connects inside the VDT, on the A21 filter board. If you are using the mechanical keyboard, you will be able to bring out the Keyboard Strobe signal from the A3 board. Pin 44 is active low and pin 46 is active high.

If you want software control of the Screen Erase and Cursor Home functions, a less elegant modification can be made. Remove IC39 from the A2 board and bend pin 8 of the IC up so that it will no longer make contact with the board. Put the IC back into position 39 where it was. Run a jumper wire from pin 8 of IC39 (the one just bent) over to either pin 2 or pin 8 of IC34 on the A4 board. Use a connector of some sort so that the two boards may be easily separated later. This change creates a wire-ored connection between the Screen Erase function and the ETX detector. Now each time ETX is received by the terminal, the screen will be erased and the cursor will home to the upper left-hand corner. The VDT accomplishes this by zeroing the delay line memory. This takes one frame time, or 16.7 milliseconds. A software delay must be provided to prevent the computer from sending more data during the erase time. These modifications are summarized in Fig. 1.

Improvements

The modifications just described will prohibit Screen Read operation. To retain that feature, a more elaborate scheme could be used which gates the decoding ICs on the A2 board using a single switch to choose the type of operation you want. A UART could be added to the keyboard to provide serial transmission in both directions.

Conclusion

The RCA 752, although ancient by today's standards and techniques, comes available to the hobbyist for just that reason. Yet it can provide a low cost terminal with features that demand a very high premium if purchased new. If you come across one, you might also look for some of the other options available with it (and similar surplus terminals). Those options include the capability of plugging in a printer for hard copy direct from the screen, and a variable screen format which provides for almost any combination of lines and characters/line which total 1080 characters.

My thanks to Kurt Lessor and Andy Demland for their help in the rejuvenation of my terminal. Incidentally, I found a Z-80 Digital Group system under the Christmas tree this year. It uses a TV-based philosophy and I saw a very nice commercial monitor at the surplus store . . . ■

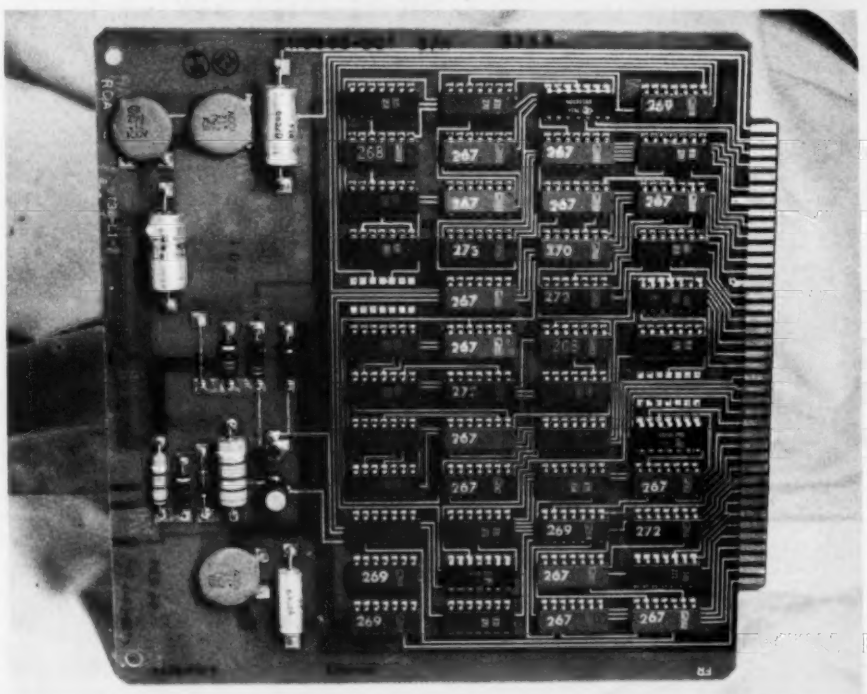
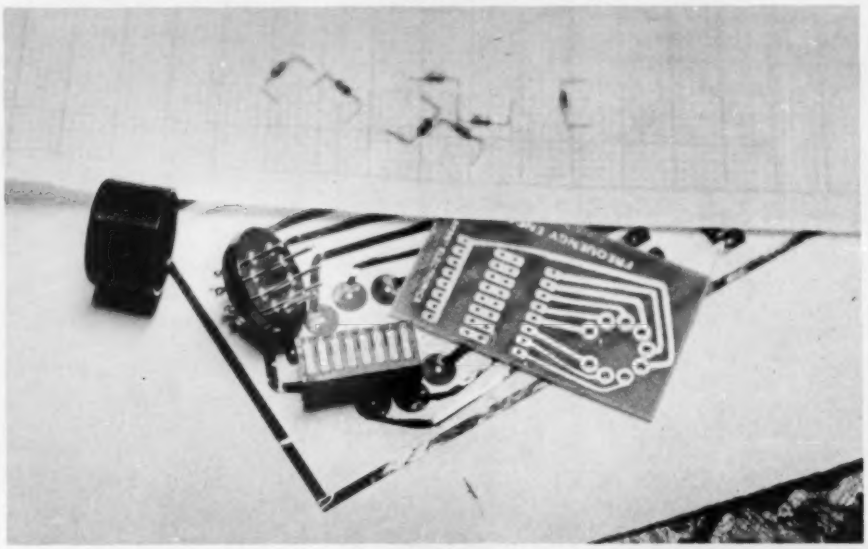


Photo 4. A typical logic board. ICs are numbered starting at the upper left.

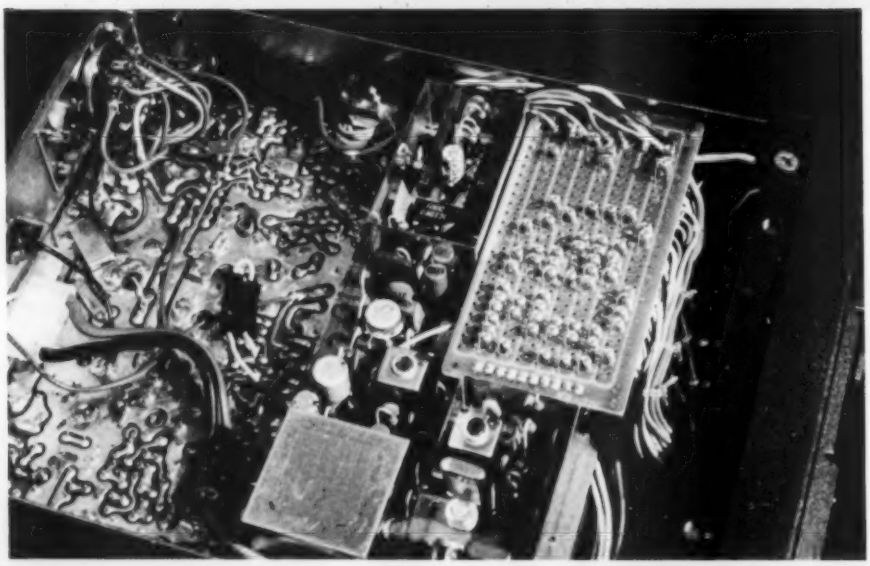
Circuit board with components. IC-22S plug, dip switch, and diodes are all the parts required. Circuit board design layout before reduction can be seen beneath parts.



Bill Richarz WA4VAF
4124 Colebrook Road
Charlotte NC 28215

More Channels for the IC-22S

-- using dip switches

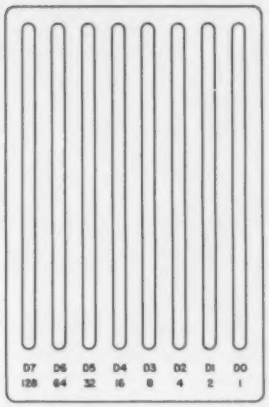


Interior view of IC-22S showing wires added to matrix board and soldered to accessory socket. Note wires are kept close to edge and taped together for a neat installation.

Icom's introduction of the 22S has ended the day of waiting for the mailman to bring those crystals for a particular frequency – that is, if you happen to own one of these little marvels.

The very same day I purchased my rig from the local dealer, I had completely programmed the matrix board for 22 channels by nightfall. For those of you that have not seen, heard, or owned the 22S, let me explain. Switching diodes are soldered to a very small matrix board which is plugged into the transceiver. A chart in the instruction manual indicates placement of the diodes for 128 frequency combinations, with 15 kHz spacing. A channel switch allows you to select one of 23 programmed

Fig. 1. Matrix board of IC-22S.



Matrix Board	128	64	32	16	8	4	2	1
Diode Position or Dip Switch On	D_7 8	D_6 7	D_5 6	D_4 5	D_3 4	D_2 3	D_1 2	D_0 1
146.34 MHz	X						X	
147.18 MHz	X		X	X	X		X	

Fig. 2.

frequencies. I will not go into detail how this works; the important thing is, one need never purchase another crystal.

This brings us to the reason for this article. With 22 channels already programmed, I had only room left for one channel, which I had decided to add at some future date. I began looking at additional frequencies that I could program into the 22S, and discovered there were quite a few. Once I picked the final unprogrammed frequency and soldered in the diodes, I was finished. I would really be in worse shape than a crystal rig owner. He could change frequencies just by pulling a crystal out and plugging another in. To change a frequency in the 22S entailed the removal of a diode or two, and adding others into their proper positions. I found, while soldering the diodes to the board, that to make a mistake and have to remove one required three hands. The board itself would not take this type of abuse too many times.

At this point I decided there should be some way to switch those diodes in and out externally. After all, there are 128 selections available, and I might as well be able to take advantage of their use. One reason I had not programmed channel 23 was the deletion of a wire from the channel selector switch to the 23rd position on the matrix board. For some unknown reason, Icom overlooked this. There was a blank lug on the channel selector switch, so I ran a small stranded wire, similar to the others, from the blank lug to the 23rd position on the board. Channel 23 became the first white dot after channel 22. This was also to be the channel I would be able to program externally, by some type of switching arrangement.

By careful inspection of the matrix board and the schematic, I had a working idea of the design. The anode of each diode on a specific channel has 9 volts applied to it by selection of the channel switch. Their anodes are also common to each other. The cathodes of the diodes are soldered into selected holes marked D_0 to D_7. By simple mathematics, I concluded it would take 9 wires to run from the board to a switching arrangement. The accessory socket just happens to have 9 lugs to run the 9 wires. One of these lugs has a blue wire soldered to it, which is a metering point for the discriminator. Another lug is grounded with a .01 capacitor soldered between the blue

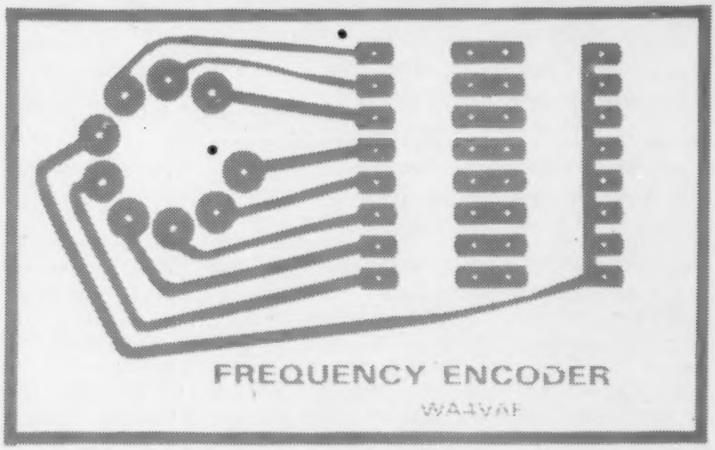


Fig. 3. Foil side of PC board shown actual size.

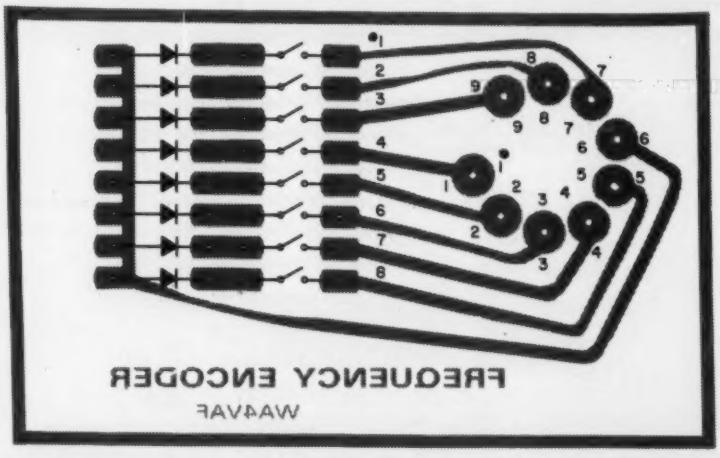
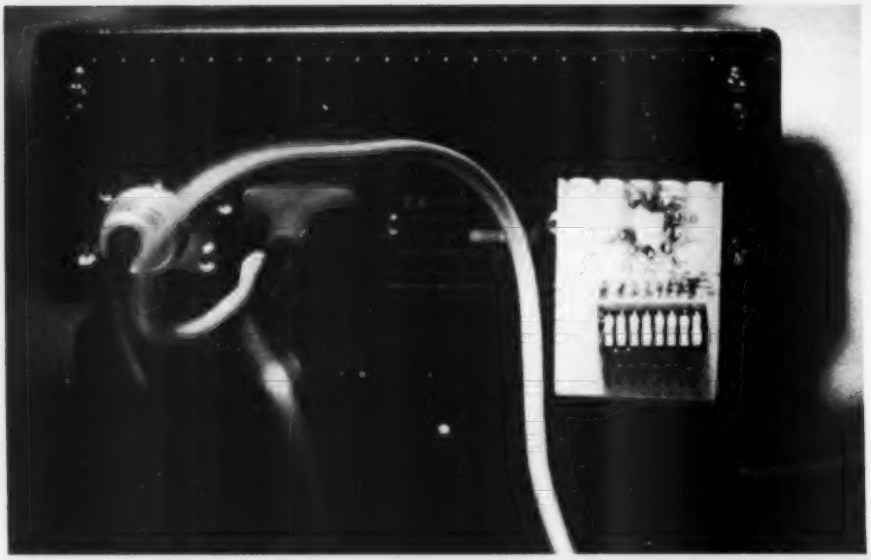


Fig. 4. Parts placement. Parts side of PC board with switches. Note pin 6 is the common anode lug, while the other lugs have the wires on accessory socket going to the matrix board soldered to them to allow the board to be positioned parallel to the 22S. The prototype protruded downward in a precarious position. Also note that the plug is soldered onto the foil side of the board.



Prototype board plugged into accessory socket of IC-22S. The author still uses this original on trips. The new board is a snugger fit, but the accessory socket had to be wired differently since the board was rotated to the left by 90 degrees.

wire and the ground lug. These were removed from the socket. The blue wire was rolled up and taped aside, while the capacitor was saved and the ground connection removed from the other lug. This allowed me to return the rig to the original condition at any time.

At this stage I ran a wire from the common anode connection of channel 23 of the matrix board to pin 6 on the accessory socket. At each diode position where the cathodes were normally connected (numbered D_0, D_1, D_2 on to D_7; see Fig. 1), I soldered a small wire and ran these to the socket and soldered them to lugs 1 to 8.

Now all I needed was external switching that would permit me to switch each diode in or out of the circuit. I ruled out some sort of minibox with toggle switches as being too bulky and also distracting from the clean-cut looking design of the 22S.

Sometime back, while thumbing through *73* looking over the ads in the I/O section, I came across a 16 pin mini-dip rocker switch. I decided this would be my switching device. Can't get much smaller than that. Since I had to plug the accessory plug into the rear socket, I proceeded to design a PC board which would be soldered directly to the pins on the rear of the plug. Just unscrew the cap on the plug and discard. I came up with a very small board which, when soldered to the plug along with the mini-dip rocker switch and 8 diodes, made a neat package that allowed me to plug the whole thing into the IC-22S.

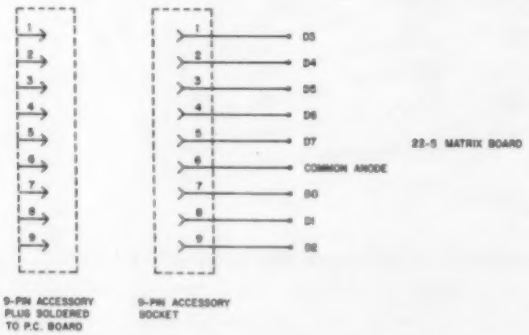


Fig. 5. Connections from 9 pin accessory socket to channel 23 on 22S matrix board.

The mini-dip rocker switch interconnects the plug and the 8 diodes. All the anodes run directly to pin 6. The cathodes can be switched in or out, or off and on, as the rocker switches read — thus, instant programming at the flip of a dip switch. Just look up the frequency on the chart in the instruction manual, and push the switches on or off with the tip of a ballpoint pen. The scheme works as if they were soldered to the matrix board itself, and I have found no undesired effects.

One word of caution: Don't try to do this while driving on the freeway. I usually throw the thing into the glove compartment for trips out of town or a vacation. The night before, I check my road map along with the *73 Repeater Atlas*. If a set of strange repeater frequencies come up I'd like to be able to work, out comes the little board. With the aid of the programming manual, in less than a minute I'm ready for that heretofore unaccessible repeater. The dip switch is numbered 1 to 8. I knew I'd have to remember the program is D_0 to D_7, or relabel the program D_1 to D_8. This is what I did; I had it reduced about ¼ the size of the original and then laminated.

What do you do if you lose your programming chart or forget it? Here is a simple formula that will give you the diode placement or switching input for the mini-dip switch:

$$N = \frac{(f-146.010) + 108}{.015}$$

where N = Number, f = frequency desired in MHz.

Example: frequency desired (f) = 146.34.

$$N = \frac{(146.34 - 146.010) + 108}{.015}$$

$$N = \frac{.33 + 108}{.015}$$

$$N = 22 + 108$$

$$N = 130$$

The programming table refers to this number under total "N". If you look at 130 in your manual, you will see it is indeed 146.34. But how does this number help in positioning of the diodes or, in our case, the switching of the external programmer? If you will notice the matrix board to which the diodes are soldered, you will see the numbers below each diode position. Starting with D_7, the number below it is 128, while D_6 is 64 and D_5 is 32. We can see at once each number is halved. You should be able to remember this; if not, make a chart as shown in Fig. 2, used for the example above.

Recall that earlier we received an answer of 130 for the frequency of 146.34. To obtain the position of each switch, simply find the largest number on the chart that will divide into our number of

130 (128 in this case). Put an X under D_7 or switch 8 depending on how you make up your chart. We now find that we have a remainder of 2. Find the next highest number on the chart that will divide into 2. Position D_1 or switch 2 will be found under the number of 2, with no remainder. Put an X at this position. When you have divided the remainder by the largest number each time, and finally have no remainder, you have completed the program. Be sure to mark an X in each position you used that number. Let's take a more complex example to see what happens when the number is too small to be divided by one of the 8 numbers on the chart.

Example: frequency desired (f) = 147.180 MHz.

$$N = \frac{(147.180 - 146.010) \div 108}{.015}$$

$$N = \frac{1.170 \div 108}{.015}$$

$$N = 78 \div 108$$

$$N = 186$$

Therefore: 186÷128=1 with a remainder of 58 (X at Position D_7). 58 cannot be divided by 64 so leave position D_6 blank. 58 can be divided by 32, so put an X at position D_5. We now have a remainder of 26. 26 can be divided by 16, so put an X at D_4. The remainder is now 10, which can be divided by 8. Put an X at position D_3. 4 will not divide into our remainder of 2, so leave D_2 blank. We do put an X at position D_1, since 2 will divide by 2. Since we have no remainder, D_0 is also left blank, and that completes the program for this particular frequency. All that's left to do now is switch the mini-dip rocker switches to the on position under the numbers where you have placed an X.

External frequency programming boards on IC-22S. Board on right is prototype. Board at left is the new design which fits rear of the 22S a bit snugger. Note plug is soldered to foil side of boards.

I carry a copy of this formula in my billfold and, after several moments of calculation, I have the correct switching inputs. This can be explained in computer terminology, but this method keeps it simple and allows the average ham with no background of this type to find the switch positions without cluttering his mind with computer logic. That's what the I/O section is for.

Back to the external switching board. Very few parts are required. The accessory plug comes with the 22S, as well as the diodes; just remember to save 8 of them. If you need more, a diode such as the 1N914 can be found from several mail-order houses in *73* at real bargains. The same goes for the mini-dip switch too, although I picked several of these up at a local hamfest at a buck apiece. Parts placement is shown in Fig. 4. This final layout of the board allowed a closer fit to the rig. You can outboard the thing into a box as I mentioned earlier, but for a compact neat switching circuit, you will probably want to make a board.

I've been using the prototype board I made for several months now. It certainly beats carrying a soldering iron around with you, and it's like having a crystal pack with 128 crystals at your disposal. When I want to change frequencies, all I do is "flip my dip." ■

Note: A drilled board complete with instructions can be obtained from the author or from Bryant Electronics, 1915 E. Independence Blvd., Charlotte NC 28205, for $4 ppd.

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Try a Scandie-Talkie

-- build a scanning HT

One of the most all-time popular and universally utilized amateur radio transceivers is the two meter FM handie-talkie. Proudly displayed by their owners, they appear at hamfests, flea markets, walkathons, parades, and other public service events as the easiest, most reliable form of quick communication. More and more mobile ops use them so they can take their rigs along from their cars, preventing theft of a car-mounted FM transceiver. Dangling one from your belt has the added advantage of imbuing you with instant high-class ham radio social status. Anyway, they're great fun. But the problem for the uninitiated has always been trying to get one of your own for something less than the minor fortune required for most of these gems.

Photo 1. Scandie-talkie and obviously gleeful author in dorm room ham shack.

This article explains how easy it is to home brew/kit-bash your own HT, with features of no other talkie available anywhere, and at a low cost. Its features are:

Four channel scanning receiver, one channel (easily expanded) transmitter. The scanning feature lets you monitor several repeaters at once, or a mix of repeater and simplex channels. Don't miss a call from a friend because you couldn't listen to more than one frequency; now you can "time-share" your channel snooping! Of course, you can always switch to the manual mode or lock out channels you don't want to scan at any time.

First-class performance, with highly selective sensitive receiver and 1 Watt transmitter. The receiver section is the most important part of any rig, and this one has big advantages over using a cheapie tunable police band monitor as the receive section of the HT. Two rf stages, double conversion, two ceramic i-f filters, and crystal-controlled. No mickey-mouse compromises.

Easy-to-get main parts; the receiver is ready-made, the transmitter is an easily built kit.

Lower cost than the least expensive commercial HT! Even if you bought everything new, it would only come to about $135 (and don't forget this one *scans*). If you're not too impatient and like to attend flea markets or auctions, you can build it for about $50-75.

Hand-held designed so that the receiver alone can be removed in seconds, its own battery pack snapped in, and used as a pocket scanning monitor.

External mike built in; no need to go to extra expense since everyone uses one anyway. Push-to-talk, of course.

The Receiver Section

The receiver I used for my scandie-talkie is a Radio Shack Realistic (registered trademark) PRO-5 UHF pocket scanner, which I converted to two meters. Radio Shack also manufactures a PRO-4A VHF-high band only pocket scanner, as well as a PRO-6 VHF-high/low band model. Other pocket receivers are made by Pace, Johnson, and several scanner manufacturers. Alternately, Tempo makes a new tiny pocket scanning receiver, and a 12 channel fixed receiver which could be used. All are excellent receivers, and when tuned up as outlined below, compare with the best commercial HT receiver. Their selectivity alone makes it worth the nominal extra cost over a tunable public service

Photo 2. Note classy poster backdrop, also collapsible whip antenna stuck into antenna jack of HT.

band receiver — a PSB rig just won't cut it unless there's only *one* very strong local repeater and you don't like simplex operation!

I bought my well-used scanner for $15. I've seen them go for $30-45 at flea markets and auctions, if you want to wait for one. You'll save a good deal of cash if you do wait — particularly if you can bargain person-to-person at a flea market table and not get stuck bidding away your savings in an auction. Of course, you can buy a brand new shiny one at Radio Shack almost anywhere. The modifications I describe here won't lower the resale value in any way, nor destroy the rig's appearance. All can be restored to the original.

If you get a PRO-4A, 5, or 6, the first step is to remove the batteries in their little snap-in case. Save this case because you can use it when you want separate monitor-only operation. Remove the two screws at the bottom of the case, squeeze the sides of the case half (with the speaker grill on it) near the crystal socket cover, and pull the bottom of the case back and away. There's a screw in the middle of the PC board, and when you remove it, you can separate the other half of the case from the board.

Look at Photo 5 and notice the small PC board mounted on top of the larger one. That smaller board has the front-end and mixer which determines the band for which the receiver was designed. The larger PC board has the i-fs, filters, oscillators, and scanning/audio/squelch circuits — they're essentially the same for all three models.

Of course, the VHF-high and VHF-high/low band models, the PRO-4A and the PRO-6, don't need conversion, only tuning to optimize their two meter performance. More on this later. To convert the UHF PRO-5 receiver to two meters, all you have to do is make some air-wound coils to replace the three UHF hairpin coils on the front-end/mixer board. You can see the ones I made in the photo, on the small board. They are 6 turns, #22 solid tinned wire, 5/16" long and ¼" in diameter each. To replace the originals with these, use a solder sucker and schlumpf up the solder on the pins which hold the small board to the larger one. Gently pry the two boards apart. Now use the solder sucker to remove the solder from the ends of the three UHF coils, and also from the tap wires where they connect

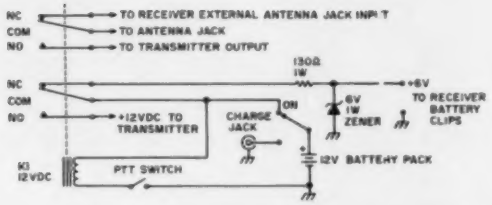

Fig. 1. Hand-held wiring schematic, showing relay hookups and receiver 6 V regulator wiring.

to the coils. Leave the tap wires in the board. Now solder in the new coils, and put the taps at about the same relative position on these coils as on the UHF ones (e.g., if the UHF tap was about ¼ of the way up from one end of the total winding, the VHF tap position would also be ¼ way up the total winding). Save the UHF coils in case you ever want to put the receiver back on that band. Clean, remount, and solder the front-end/mixer board back on the main PC board, and you're finished with this simple conversion.

Once you've got the VHF coils in place, tuning up the receiver is just like tuning up the VHF-high and VHF-high/low models — tweaking three trimmers and two coil slugs. Tuning all three models is strongly recommended for maximum performance on two meters, since all these radios come from the factory stagger-tuned for a broad response from the 148-170 MHz. This leads to poor sensitivity on 146 MHz and sometimes severe image and cross-talk problems. If you maximize the front-end response for on a frequency near midband in the FM segment of two meters, all those bad responses disappear and the sensitivity is much enhanced.

I tuned my receiver by inserting a 2 meter crystal, listening to a weak signal, and peaking the three trimmers on the front-end board for maximum response. Use an insulated tool for this! Then I touched up the i-f input coil, shown on the photo next to the front-end board. With the weak signal input removed, adjust the oscillator coil (near the crystals) for maximum noise. Repeat the procedure a few times — be sure to keep the input signal well below full noise quieting — and optimize the front-end trimmers as a last step. Now you've got a first-quality selective scanner with a sensitivity of about 0.5 uV. By the way, Radio Shack has avail-

Photo 3. Close-up of talkie with author's other ham gonk. Rubber ducky installed; microphone on its bracket.

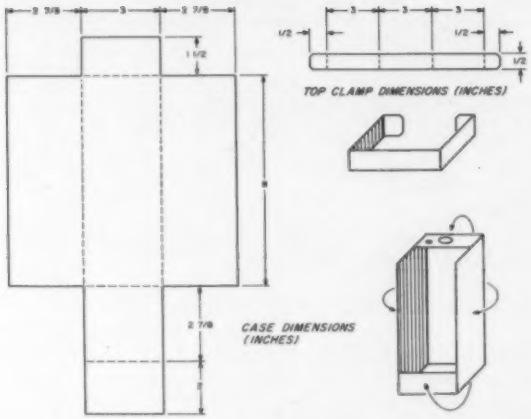

Fig. 2. Aluminum case, clamp dimensions, and fold lines.

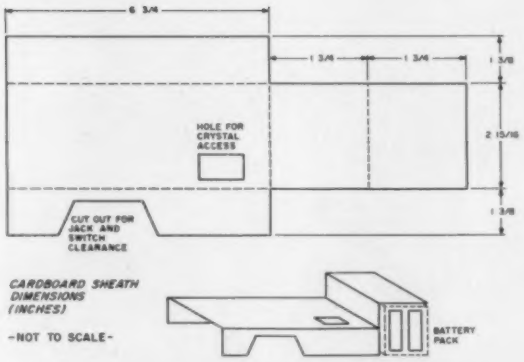
HOLE FOR CRYSTAL ACCESS
CUT OUT FOR JACK AND SWITCH CLEARANCE
CARDBOARD SHEATH DIMENSIONS (INCHES)
-NOT TO SCALE-
BATTERY PACK

Fig. 3. Cardboard sheath dimensions and folding guide.

able on order service manuals for the PRO series; these are about $2 each. The one for the PRO-5 is #20-169.

Hint: A good weak-signal source is a cheapie tunable VHF-high band police receiver. Tune it to about 157 MHz and listen for its oscillator (at about 146 MHz) on the scanner. Orient the two for the signal level needed. Be sure to tune the police radio carefully — these pocket scanners are very selective and you might swish the oscillator right through their passband.

Since you'll need crystals for this gem, Radio Shack can supply them (fast!) for $6 a throw. If they're not in stock at the store for the frequencies you want, they will have them sent within a week. However, regular monitor crystals work fine (3rd overtone, approximately 45 MHz output) and are usually cheaper. Tufts Radio carries this type for $4.50. I have an Icom IC-22A and alas! its receiver crystals don't work. The 22A uses 15 MHz fundamental crystals and they will oscillate in the scanner, but in a third-overtone mode, about 30 to 60 kHz off their marked frequency! Oh, well, monitor crystals are cheap and easy to get . . .

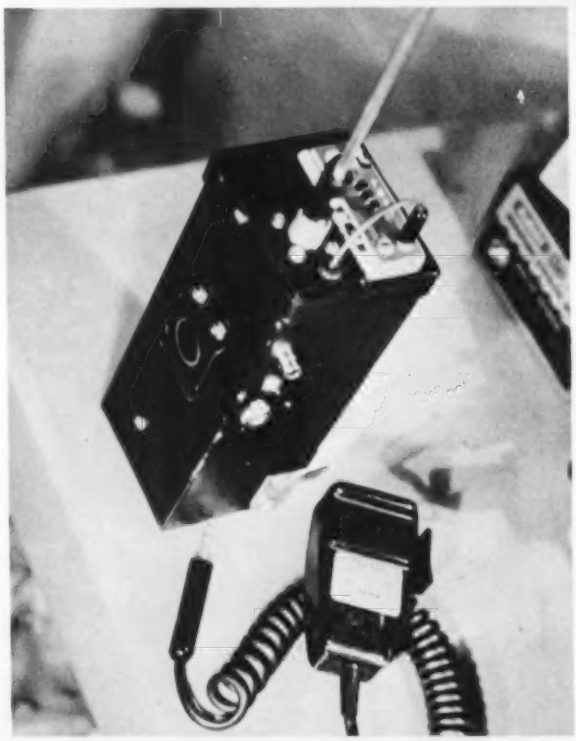

Photo 4. Another view showing belt clip, jacks, and power switch.

The Transmitter

The model TX-144 transmitter can be purchased in kit form from VHF Engineering, 320 Water Street, Binghamton, New York 13092. It is well designed, easy to build, costs only $29.95, and puts out a peppy, well-modulated 1 Watt signal. Mine is mounted with brass brackets that hold it about 1/16" off the HT case, soldered to each end of the PC board. The transmitter will take any low-impedance (500 Ohms) microphone, including a carbon mike, which is what I used. Follow the directions with the kit to see how to hook up any variety of microphone you may have handy.

By the way, the carbon mike you see in the photos is a Telex TEL-66C noise-cancelling affair, the classy kind you see private pilots using. Mine, in fact, did come from a well-worn aircraft. It's ideal for a handie-talkie because it tends to reject wind, street, or other noises normally present in portable operations. It's also quite lightweight.

Crystalling up the transmitter is a bit more simple than the receiver. Icom crystals work, as do any crystals in the 18 MHz range. These are available nearly anywhere. You may find, as I did, that the capacitor in parallel with the TX-144's crystal trimmer is a bit too large. I changed it to a 12 pF ceramic trimmer (it was 22 pF fixed silver mica), and now all the crystals tune in on frequency when the main trimmer is at half-mesh.

I have used this single-channel version for months now, but should you want more transmit channel capability (you already have 4 receive channels), it's a simple matter to add a few more crystal sockets. Mount a micro "PC board" size rotary switch on the case underneath the mike jack. There is plenty of room, as you can see in Photo 6.

Wiring and Switching

Fig. 1 gives the wiring schematic for the transmitter-receiver. The relay performs two functions — switches the antenna from the receiver to the transmitter, and similarly switches the +12 V dc line between the two. This relay is a tiny little 12 V affair I found at a flea market, Potter and Brumfield HP-4038. Most any kind of small 12 volt DPDT relay should work. It should

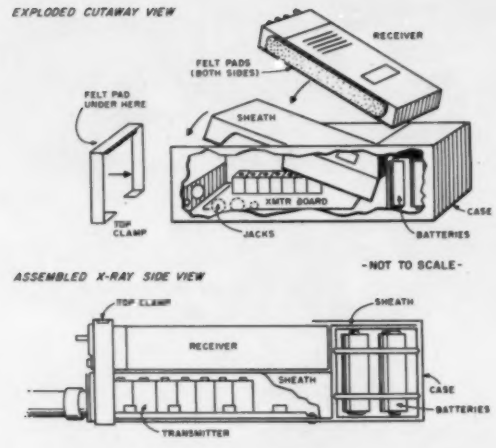

Fig. 4. Assembly sketches.

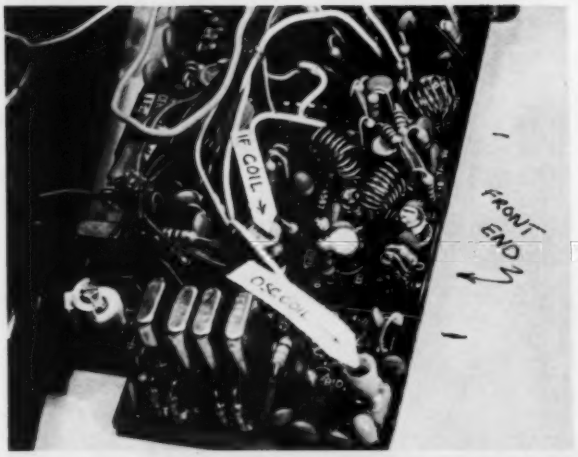

Photo 5. Inside PRO-5 receiver, showing new front-end coils and main PC board alignment points.

be mounted as close to the antenna jack and transmitter power output port as possible. Short leads minimize losses! The receiver signal is routed through a short length of RG-174/U subminiature coax to a mini phone plug which connects into the external antenna jack of the scanner. It goes through a grommet where it passes through the metal case. The photos reveal all.

The scanning receiver uses 6 V dc while the transmitter runs on 12 V. Rather than having awkward plugs sticking out all over the thing, or running the receiver off its own batteries and having to use a complicated relay, I made a 6 V regulator built around two insulated mini alligator clips. The clips go on the receiver's battery contacts and the zener diode and resistor fit neatly in the vacant battery compartment. Now everything in the HT runs off 12 V. Then, if you ever want to use the receiver separately, you just unclip the regulator and snap in the original battery pack. Versatility!

Don't forget to include the charging jack for the handheld's batteries. It's switched in when you turn the rig off, and also provides direct access to the 12 V supply at that jack so you can run other projects off the batteries without taking them out of the case.

The Case – Boxing It Up

The case is made from a sheet of aluminum 1/16" thick. Fig. 2 shows the dimensions and folding lines. It's not too difficult to bend with a bench vise and a good supply of hardwood blocks. Use a mallet and cloth to avoid hammermarks and vise teethmarks.

The top lip is drilled and filed out to accept the SO-239 antenna jack. Or, you can mount a BNC jack there instead. Don't forget a hole for the receiver's antenna coax, big enough so a grommet will fit there. The little clamp-bracket shown slips over the case and holds the receiver's top section in place, the bottom of the receiver being held by the case's battery holder lip.

Looking down the case, the charge/12 V jack is on the left side at the top rear, then the power/charge switch, and finally the microphone jack. The microphone holder bracket is mounted at the lower front of the left side. Be sure you saved the belt clip from the pocket scanner – mount this at the rear of the case so you can hang the rig from your belt or anywhere else you care to clip it.

Figs. 3 and 4 and Photo 9 show the way the whole thing is put together. The batteries are at the bottom; jacks, wiring and transmitter are mounted at the back of the case; and then the whole thing is covered with a cardboard sheath so the receiver can set on top. Works great. Make a hole in the cardboard to get access to the transmit trimmer and crystal, and slip another thin sheath of cardstock over it so the receiver's regulator wiring doesn't get into the transmitter through the hole. The receiver is pressed into the case with heavy felt placed at either side of its cabinet, then the top clamp is slipped over the whole works. The top clamp also has some felt at its inside front, so that the receiver is firmly cradled into place with the thick felt. The result is a rugged mar-free compact

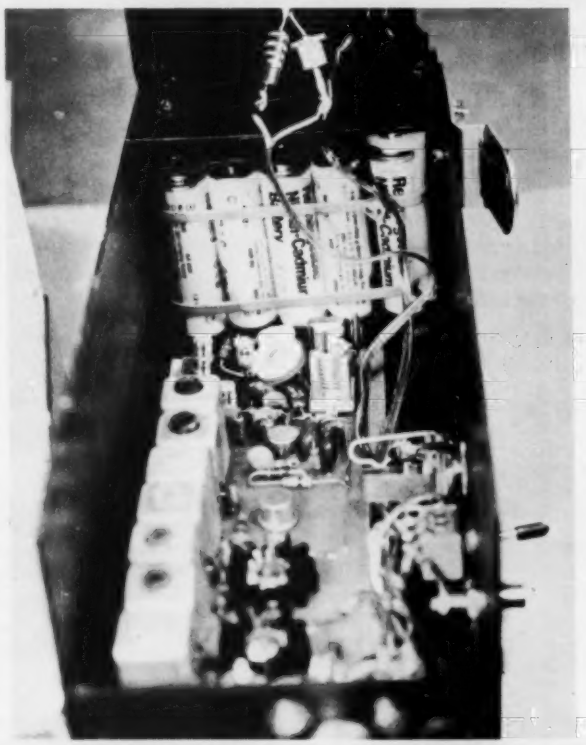

Photo 6. Cardboard sheath removed, looking down into battery compartment. Notice the 6 V regulator zener and resistor clipped inside receiver.

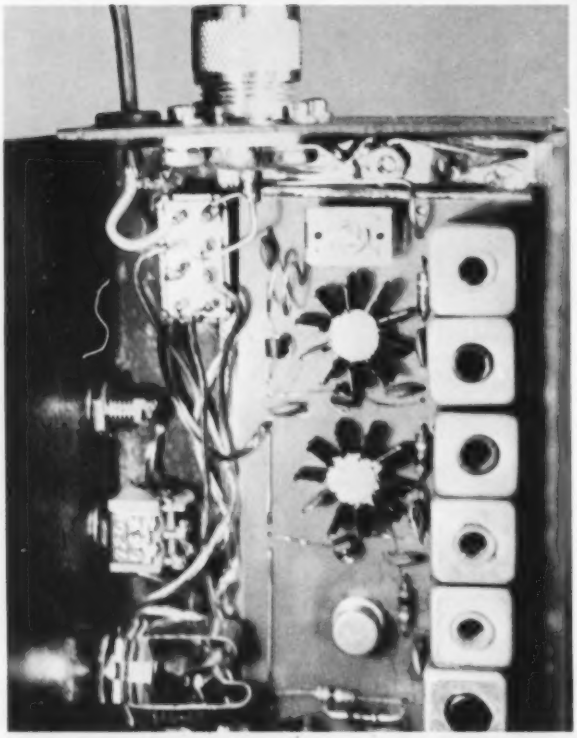

Photo 7. Close-up of the business end of the HT, showing the relay wiring.

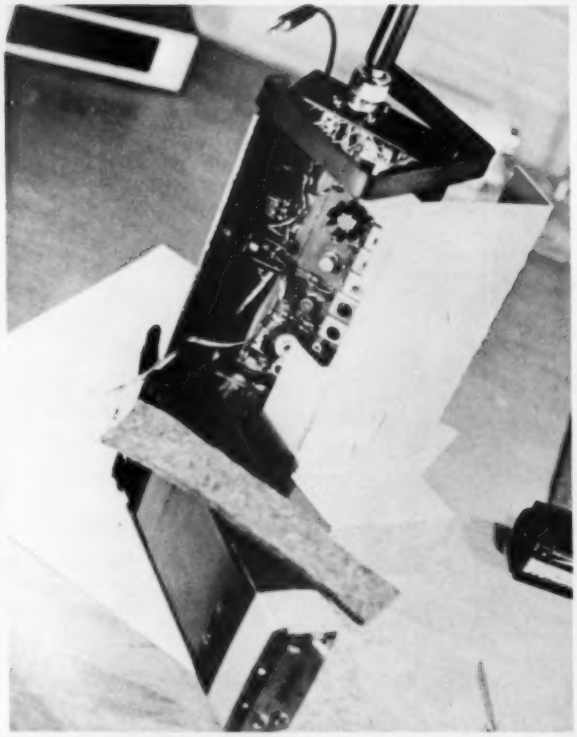

Photo 8. Case, sheath, clamp, receiver, and felt ready to go together.

unit.

Batteries

The battery choice is pretty much left to the builder, but I strongly recommend using nicads instead of carbon-zincs. The design leaves room for the 10 nicads I've lashed together with cable ties, as shown in the photos and figures. The cardboard sheath for the rest of the transmitter/power circuits also extends to cover the top of the batteries so their power connectors (made from the tops of old 9 V batteries) won't short out against the metal case.

Results and Conclusion

This HT is no toy, nor does it involve any compromises. Its performance emphasizes this over and over again. It hears 'em all and talks up there with the higher power rigs.

I've had many hams ask me if the scandie-talkie was commercially built. It always gets much interest wherever I go, particularly with the pretty red blinking LEDs scanning across the top attracting attention. I've had a great deal of fun using it for quick and reliable portable communications. I never miss a call with that scanner going!

Build this HT and join the fun of portable operation with a professional looking, sounding, and performing rig. And this two meter talkie does what no other hand-held does – it scans! ■

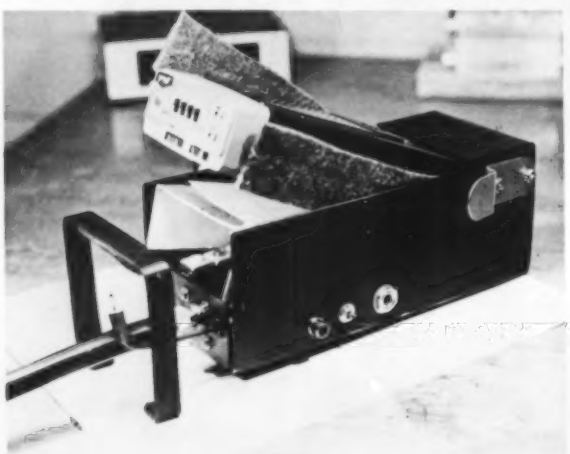

Photo 9. Nearly assembled . . .

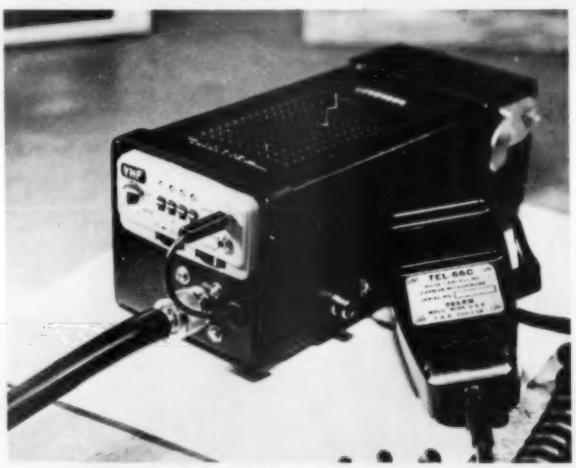

Photo 10. Presto! A super HT!

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RX28C W/T	same as above—wired & tested	104.95
RX50C Kit	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX50C W/T	same as above—wired & tested	104.95
RX144C Kit	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T	same as above—wired & tested	114.95
RX220C Kit	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T	same as above—wired & tested	114.95
RX432C Kit	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RX432C W/T	same as above—wired & tested	124.95

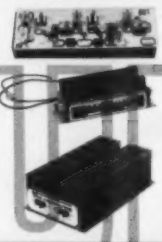
RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50
RF28 Kit	10 mtr RF front end 10.7 MHz out	12.50
RF50 Kit	6 mtr RF front end 10.7 MHz out	12.50
RF144D Kit	2 mtr RF front end 10.7 MHz out	17.50
RF220D Kit	220 MHz RF front end 10.7 MHz out	17.50
RF432 Kit	432 MHz RF front end 10.7 MHz out	27.50
IF 10.7F Kit	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TRANSMITTERS

TX50	transmitter exciter, 1 watt, 6 mtr	39.95
TX50 W/T	same as above—wired & tested	59.95
TX144B Kit	transmitter exciter—1 watt—2 mtrs	29.95
TX144B W/T	same as above—wired & tested	49.95
TX220B Kit	transmitter exciter—1watt—220 MHz	29.95
TX220B W/T	same as above—wired & tested	49.95
TX432B Kit	transmitter exciter 432 MHz	39.95
TX432B W/T	same as above—wired & tested	59.95
TX150 Kit	300 milliwatt, 2 mtr transmitter	19.95
TX150 W/T	same as above—wired & tested	29.95

POWER AMPLIFIERS

PA2501H Kit	2 mtr power amp—kit 1w in—25w out with solid state switching, case, connectors	59.95
PA2501H W/T	same as above—wired & tested	74.95
PA4010H Kit	2 mtr power amp—10w in—40w out—relay switching	59.95
PA4010H W/T	same as above—wired & tested	74.95
PA50/25 Kit	6 mtr power amp, 1w in, 25w out, less case, connectors & switching	49.95
PA50/25 W/T	same as above, wired & tested	69.95
PA144/15 Kit	2 mtr power amp—1w in—15w out—less case, connectors and switching	39.95
PA144/25 Kit	same as PA144/15 kit but 25w	49.95
PA220/15 Kit	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit	power amp—similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10 W/T	10w in—140w out—2 mtr amp	179.95
PA140/30 W/T	30w in—140w out—2 mtr amp	159.95



Blue Line — RF power amp, wired & tested, emission—CW-FM-SSB/AM

Model	Frequency	Power Input	Power Output	
BLB 3/150	45- 55MHz	3W	150W	TBA
BLC 10/20	140-160MHz	10W	70W	139.95
BLC 2/70	140-160MHz	2W	70W	159.95
BLC 10/150	140-160MHz	10W	150W	259.95
BLC 30/150	140-160MHz	30W	150W	239.95
BLD 2/60	220-230MHz	2W	60W	159.95
BLD 10/60	220-230MHz	10W	60W	139.95
BLD 10/120	220-230MHz	10W	120W	259.95
BLE 10/40	420-470MHz	10W	40W	139.95
BLE 2/40	420-470MHz	2W	40W	159.95
BLE 30/80	420-470MHz	30W	80W	259.95
BLE 10/80	420-470MHz	10W	80W	289.95

POWER SUPPLIES

PS15C Kit	15 amp—12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	79.95
PS15C W/T	same as above—wired & tested	94.95
PS25C Kit	25 amp—12 volt regulated power supply w/case, w/fold-back current limiting and ovp	129.95
PS25C W/T	same as above—wired & tested	149.95
PS25M Kit	same as PS25C with meters	149.95
PS25M W/T	same as above—wired & tested	169.95

O.V.P.	adds over voltage protection to your power supplies, 15 VDC max.	9.95
PS3A Kit	12 volt—power supply regulator card with fold-back current limiting	8.95
PS3012 W/T	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/fold-back current limiting and overvoltage protection	239.95

REPEATERS

RPT50 Kit	repeater—6 meter	465.95
RPT50	repeater—6 meter, wired & tested	695.95
RPT144 Kit	repeater—2 mtr—15w—complete (less crystals)	465.95
RPT220 Kit	repeater—220 MHz—15w—complete (less crystals)	465.95
RPT432 Kit	repeater—10 watt—432 MHz (less crystals)	515.95
RPT144 W/T	repeater—15 watt—2 mtr	695.95
RPT220 W/T	repeater—15 watt—220 MHz.	695.95
RPT432 W/T	repeater—10 watt—432 MHz.	749.95
DPLA50	6 mtr close spaced duplexer	675.00

DPLA144	2 mtr, 600 KHz spaced duplexer, wired and tuned to frequency	379.95
DPLA220	220 MHz duplexer, wired and tuned to frequency	379.95
DPLA432	rack mount duplexer	319.95
DSC-U	double shielded duplexer cables with PL259 connectors (pr.)	25.00
DSC-N	same as above with type N connectors (pr.)	25.00

TRANSCEIVERS

TRX50 Kit	Complete 6 mtr FM transceiver kit, 20w out, 10 channel scan with case (less mike and crystals)	249.95
TRX144 Kit	same as above, but 2 mtr & 15w out	219.95
TRX220 Kit	same as above except for 220 MHz	219.95
TRX432 Kit	same as above except 10 watt and 432MHz	264.95
TRC-1	transceiver case only	19.95
TRC-2	transceiver case and accessories	39.95

SYNTHESIZERS

SYN II Kit	2 mtr synthesizer, transmitt offsets programmable from 100 KHz—10 MHz, (Mars offsets with optional adapters)	169.95
SYN II W/T	same as above—wired & tested	239.95
MO-1 Kit	Mars/cap offset optional	2.50
TO-1 Kit	18 MHz optional tripler	2.50

WALKIE-TALKIES

HT 144B Kit	2 mtr, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex	129.95
NICAD	battery pack, 12 VDC, ½ amp.	29.95
BC12	battery charger for above	5.95
Rubber Duck	2 mtr, with male BNC connector	8.95

OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/diode switching	$ 6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD3 Kit	UHF version of CD1 deck, needed for 432 multi-channel operation	12.95
CDR2 Kit	carrier operated relay	19.95
SC3 Kit	10 channel auto-scan adapter for RK with priority	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each)	5.00
CWID Kit	129 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed	59.95
MIC1	2,000 ohm dynamic mike with P.T.T. and coil cord	12.95
TS1 W/T	tone squelch decoder	59.95
TS1 W/T	installed in repeater, including interface accessories	85.95
TD3 Kit	2 tone decoder	29.95
TD3 W/T	same as above—wired & tested	39.95
HL144 W/T	4 pole helical resonator, wired & tested, swept tuned to 144 MHz ban	24.95
HL220 W/T	same as above tuned to 220 MHz ban	24.95
HL432 W/T	same as above tuned to 432 MHz ban	24.95

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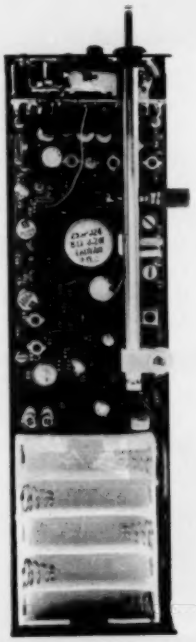
FULL LINE CATALOG

WALKIE-TALKIE KIT
HT-144B TWO METER F.M. PORTABLE

- 2 Watts Minimum
- 4 Channels
- .35 mV for 20dB of quieting
- Low battery drain . . . less than 10 Ma
- Now you can build a commercial quality walkie talkie at home at half the price.
- Designed with the ham in mind. Average assembly time, just 10 hours.
- Small and handy, yet large enough to be assembled with conventional tools.
- Attractive, scratch resistant textured finish.
- Lightweight, sturdy aluminum case.

KIT . . . — includes crystals for 52 simplex (less batteries).



WALKIE-TALKIE SPECIFICATIONS
HT-144B

- Black textured case 1-1/2 x 2-1/2 x 9-1/4
- All tunable coils are prewound
- Transceiver is on one G-10 predrilled board
- Parts layout silk-screened on boards for easy construction
- Crystal deck is separate predrilled board
- Weight less batteries — approximately 15 oz.
- Battery-case is AA size — accepts alkaline or nicad
- External battery charging/power supply jack furnished
- 1 dual gate mosfet 2 I.C.'s 15 transistors 7 diodes
- Antenna — collapsible 17" whip
- Covers any 2 Mhz segment between 140 and 170 Mhz
- Plenty of room in case for add ons (PL and tone)

HT-144 TRANSMITTER SPECIFICATIONS: OUTPUT 2 watts miniumum. 3 DB BANDWIDTH 2 Mhz typical. STABILITY .002 typical (depends on crystal). SPURIOUS outputs down 30db or better. MODULATION true FM with varactor in crystal circuit. NETTING separate trimmers for each channel. DEVIATION adjustable to 7 Khz. AUDIO limiter and active low pass filter. MICROPHONE speaker type. CRYSTAL 18 Mhz parallel at 20 pf. MULTIPLICATION FACTOR frequency times 8. CURRENT DRAIN 500 ma typical.

HT-144 RECEIVER SPECIFICATIONS: SENSITIVITY better than .35uV for 20db quieting. SQUELCH THRESHOLD better than .25uV. STABILITY .002 typical (depends on crystal). ADJACENT CHANNEL REJECTION 60 db. SPURIOUS RESPONSES down 70db. FIRST IF 10.7 Mhz SECOND IF 455 Khz. FILTER 4 pole monolithic 10.7 Mhz crystal. DISCRIMINATOR pretuned ceramic 455 Khz. BANDWIDTH 15 Khz at 3db points. CRYSTAL 45 Mhz parallel at 20pf. CRYSTAL FORMULA receive frequency minus 10.7 divided by 3. AUDIO OUTPUT .5w typical. CURRENT DRAIN 10 ma squelched, 100 ma on voice peaks.

ACCESSORIES: "Rubber Duckie" Antenna (Including BNC Connectors and Adaptor)
Nicad Battery Charger .....
Sealed 12V Nicad Battery Pack .....

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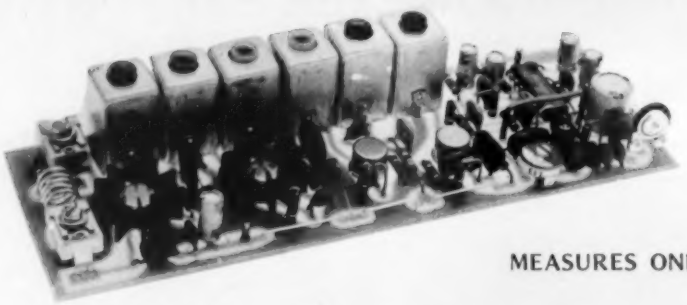
TX-50, TX-144B and TX-220B TRANSMITTER KITS

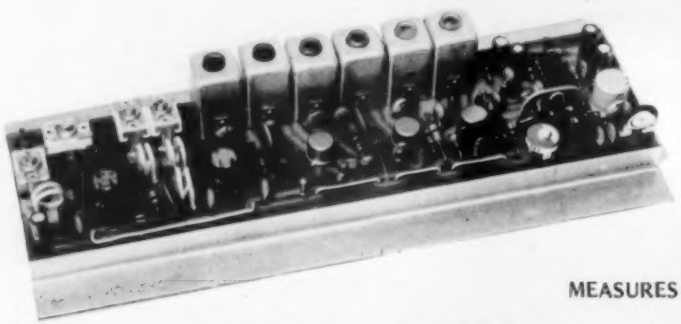


MEASURES ONLY 2" X 6" X 1"

A one watt exciter using four RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with our PA Series amplifiers for a 15 or 25 watt station. Some of the features are:

- Nominal output 1½ watts
- Deviation adjusted to 10KHz
- IC audio with clipping and active filter
- All spurious outputs down 30db or more
- Temperature compensation crystal trimmer
- Zener regulated oscillator
- Uses readily available 12, 13 or 18 MHz crystals (13MHz for 50, 18MHz for 220)
- All tuning coils prewound
- Predrilled and tinned G-10 Circuit board
- Easily built and tuned in one evening
- Multi-channel option available with addition of CD-2 crystal deck
- Will easily drive our 15 and 25 watt amplifiers to full output

TX-432 TRANSMITTER KIT



MEASURES ONLY 2" X 8" X 1'

A one watt exciter using five RF transistors, two diodes, and one integrated circuit. The RF transistors are operating well below their ratings allowing long keying periods without damage. The exciter may be used alone as a transmitter or with our PA432/10 amplifier for a 10 watt station. Some of the features are:

- Nominal output 1 watt
- Deviation adjustable to ±10 KHz
- IC audio with clipping and active filter
- All spurious outputs down 30db or more
- Temperature compensation crystal trimmer
- Zener regulated oscillator
- Uses readily available 18MHz crystals
- All tuning coils prewound
- Predrilled and tinned G-10 Circuit board
- Easily built and tuned in one evening
- Multi-channel option available with addition of CD-2 crystal deck
- Will easily drive our 10 watt amplifier to full output

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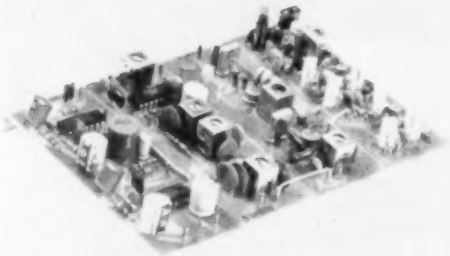
RECEIVER KITS RX-28C, RX-50C, RX-144C, RX-220C RX-432C



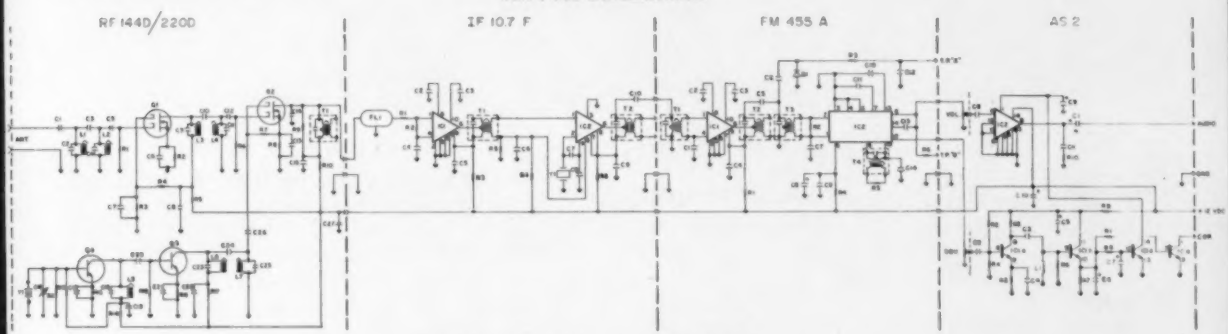
INEXPENSIVE AND UNIQUE MODULAR CONCEPT

- Performance equal to commercial equipment
- Monitor receivers
- Repeaters: using our transmitter, 15 or 25 watt amplifier and COR modules
- 10 channel auto-scan receivers: using our SC-1 scanner kit and CD-1 crystal deck
- Tranceivers using our transmitter module

All Receiver kits are dual conversion with squelch and COR output. They may be tuned to any 4 Mhz segment between 30 and 230 Mhz. (Coil data is supplied for 30-60, 144-170 and 220-230 Mhz bands.)

RX-144C SPECIFICATIONS: SENSITIVITY .3uV for 20db quieting. SQUELCH THRESHOLD .2uV. AUDIO OUTPUT 2 watts. STABILITY better than $\pm$.002. IMAGE REJECTION 60db. SPURIOUS REJECTION greater than 60db. IF REJECTION 80db. FIRST IF 10.7 Mhz. SECOND IF 455 Khz. BANDWIDTH 15 Khz at 3db, 60 Khz at 30db (40 Khz with optional 4 pole filter). CRYSTAL 45 Mhz parallel at 20pf (HC/25U holder).

RX 144C SCHEMATIC



	RX50	RX144C
IMAGE REJECTION	60 DB	60 DB
ADJACENT CHANNEL REJECTION AT 30 KHZ	40 DB	40 DB
	*	*

*NOTE: RX50 & RX144C will give adjacent channel rejection of 70 DB with the optional 4 pole filter RXCF

RF-50C

A high gain low noise front end using a J FET RF stage and dual gate zener protected MCS FET mixer. The coils tune 40-60 MHz with the Capacitors normally supplied. 30-45 MHz coverage is avilable on request. The RF 50 makes an excellent low band converter (See our Model C-50)

RF-144A/F
RF-220A/F

A high gain low noise front end using dual gate zener protected MOS-Fets. Nominal 40DB gain. (slightly less on 220) Makes an excellent converter (see our models C-144 and C-220).

IF 10.7F

A 10.7 MHz amplifier and 455 KHz converter using two IC's. A crystal filter insures excellent image rejection. Over-all gain is better than 50DB. The 11.155 MHz crystal is supplied with the kit.

FM455A

A 455 KHz IF amplifier, limiter, FM detector, and audio preamplifier using two IC's. Double IF cans insure a sharp IF response. Audio limiting starts at 20 microvolts and a 5 KHz deviation signal will provide over 1 volt output. Includes a level detection diode for signal strength test point or tuning indicator.

AS2

An IC audio amplifier with squelch. An input of .1 volts will drive a 4-8 ohm speaker to two watts. The noise operated squelch circuit gates the audio amplifier to provide positive squelch action.

Each module measures 1½ X 4. The overall dimensions are 4 X 6.

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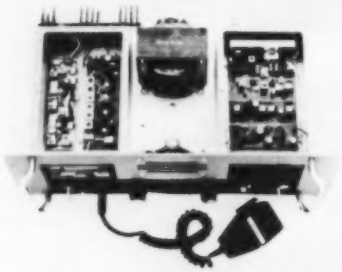
REPEATERS
RPT-50, RPT-144B, RPT-220B and RPT-432B



Why make do with a converted Mark II Gizwachi when you can get a complete repeater designed for Hams by Hams, AT A PRICE YOU CAN AFFORD. The RPT 144B, RPT 220B and RPT 432 are self-contained – all solid state machines. Conservatively rated, high quality, components deliver EXCELLENT RELIABILITY. Careful consideration has been given to both interfacing and control flexibility.

The Models RPT-50, RPT-144B, RPT-220B and RPT-432B are supplied as complete repeater systems. The receiver, transmitter, control circuitry, C. W. Identifier & 115/230 Volt AC power supply are all contained on a standard relay-rack panel and chassis unit. For most installations a user supplies AC power and suitable antennas with 50 OHM coaxial feed (PL 259 fittings). External connections for autopatch, tone control, etc. are provided. Built-in identifier programmed with up to 159 bits. Automatic emergency battery power changeover capability.

MODEL	FREQUENCY RANGE
RPT-50	45MHz - 55MHz
RPT-144B	140 MHz - 170 MHz
RPT-220B	210MHz - 240MHz
RPT-432B	430MHz - 470 MHz

TRANSMITTER

POWER OUTPUT:
- RPT50 - 20 Watts (into 50 OHMS)
- RPT1448 - 15 Watts (into 50 OHMS)
- RPT432B - 10 Watts (into 50 OHMS)
- a) All harmonics down 40DB
- b) Other spurious outputs down by more than 50DB

MODULATION: Audio processing with pre-clipping pre-emphasis
- a) Audio clipping: 6DB per octave roll off above 3KHZ
- b) Deviation: Adjustable up to 7KHZ Factory preset to 5KHZ
- c) True FM

FREQUENCY STABILITY: .0005% with commercial spec. crystals (supplied only in wired & tested units)

CIRCUITRY: All Solid State
NUMBER OF CHANNELS: 1
INPUT VOLTAGE: 115/230V AC 50-60HZ or 12-14V DC
CIRCUIT PROTECTION: 5 AMP Fuse
DIMENSIONS: Panel – Standard 19" x 7" Rack Depth behind panel 11¾"
WEIGHT: 21 pounds
SHIPPING WEIGHT: 24 pounds

RECEIVER

SENSITIVITY: .3uv for 20DB quieting Squelch sensitivity (threshold) .25uv
SQUELCH TYPE: Noise
MODULATION ACCEPTANCE bandwidth: ± 7½KHZ
SELECTIVITY: 70DB adjacent channel rejection (30KHZ)
AUDIO POWER OUTPUT: 2 Watts (minimum) to panel speaker
FREQUENCY STABILITY: .0005% with commercial spec. crystals (supplied only in wired & tested units)

Standard on both Kits and Wired Repeaters Helical Resonator, (No Helical Reasonator with RPT-50), PTT Dynamic Microphone, 4 Pole Crystal Filter, Power Supply includes fold back current limiting and over voltage protection as well as 110V/220V AC input.

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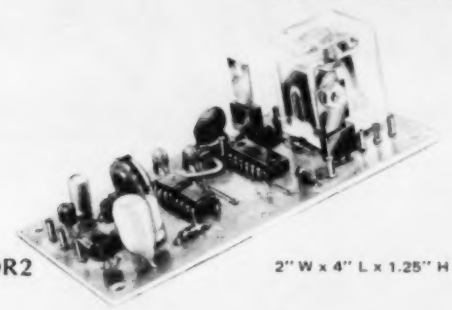
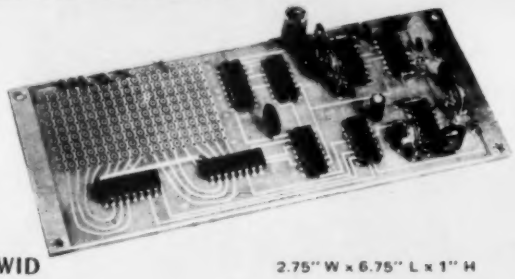
REPEATER ACCESSORIES

(SUPPLIED IN REPEATER KITS AND WIRED AND TESTED UNITS)



COR2 2" W x 4" L x 1.25" H



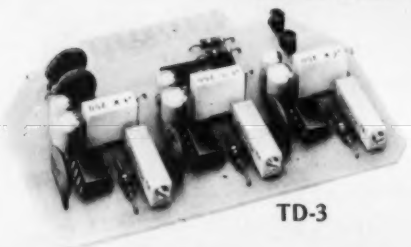
CWID 2.75" W x 6.75" L x 1" H

THE COR2 IS A COMPLETE CONTROL MODULE DESIGNED FOR USE WITH THE RX SERIES OF RECEIVERS FOR REPEATER CONTROL. THE COR2 REQUIRES LOGIC 0 OR GROUND THE P.T.T. LINE. THERE IS AN ADJUSTABLE SQUELCH TAIL TIMER .1 TO 5 SECONDS. ALSO INCLUDED IS A TIME OUT CIRCUIT WHICH IS FIELD CHANGEABLE FROM ½ TO 3 MINUTES.

THE CWID IS A 158 BIT FIELD PROGRAMMABLE CODE IDENTIFIER WITH BUILT-IN ADJUSTABLE TIMER, TONE, VOLUME, AND SPEED CONTROLS. THE TIMER 158 BIT DIODE MATRIX MAY BE PROGRAMMED WITH TWO SEPARATE MESSAGES. REQUIRES 5 VOLTS AT 200 mA.

OPTIONAL REPEATER ACCESSORIES

(MAY BE ADDED TO KITS AND WIRED AND TESTED UNITS)

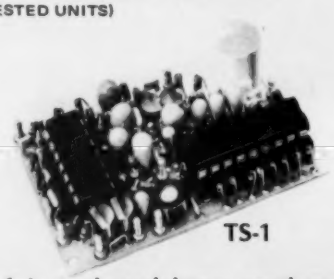


TD-3

The TD-3 is a phase lock loop, two function remote switching decoder with latch. It is fully compatible with standard Touch Tone input or may be easily adjusted to non-standard or to two-tone sequential operation.

The TD-3 has both TTL and open collector output. This allows interfacing with the RPT series of repeaters or to drive an external relay.

Complimentary outputs are available from the latch to simplify interfacing. The TD-3 operates on 5 VDC. Dimensions are 2 1/2" x 3 3/4" x 5/8" high.



TS-1

The TS-1 is a microminiature continuous tone squelch encoder-decoder. It is available in standard tones from 67.0 Hz – 203.5 Hz. Included on the board is a high-pass tone rejection filter. Decoder sensitivity is better than 10mV RMS, bandwidth, ±2 Hz max limited. Frequency accuracy is ±.25 Hz, frequency stability ±.1 Hz.

The TS-1 encodes continuously and simultaneously during decoding, independent of mike hang-up, and the TS-1 is totally immune to RF.

The TS-1 is 1.25" x 2.0" x .65" high and operates on 6-16 VDC, unregulated at 3-9 ma.

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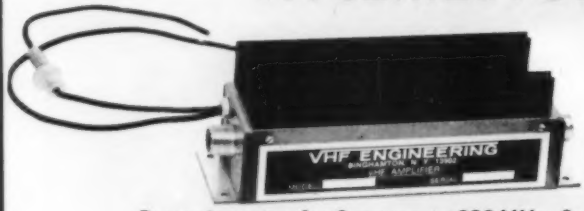
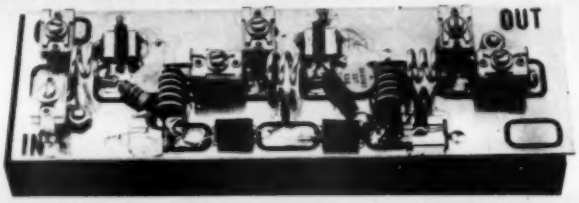
PA SERIES POWER AMPLIFIERS





Power boosters for 2 meters or 220 MHz. Solid state Class C using balanced emitter transistors for long life and high SWR protection. For FM mobile or fixed operation.

PA 144/15 and PA220/15 WATT POWER AMPLIFIERS

SPECIFICATIONS: POWER GAIN; 12 db nominal, INPUT POWER; 2 watts max., INPUT VOLTAGE; 12 to 14 volts DC negative ground, INPUT CURRENT; 4 amps max., STANDBY CURRENT; virtually insignificant, INSERTION LOSS; less than 1 db on receive, DUTY CYCLE; 50% or less.

Kit consists of drilled glass PC Board, heat sink and all components.

PA 2501 H (Kit or wired and tested) PA144/25 (Kit) 25 WATT AMPLIFIERS

SPECIFICATIONS: POWER GAIN; 15 db nominal, INPUT POWER; 4 watts max., INPUT CURRENT; 7 amps max. Complete Kit consists of drilled glass PC Board, heat sink, all components, case, connectors and solid state automatic switching.

PA4010H (Kit or wired and tested) 40 WATT AMPLIFIERS

A one stage 2 Meter amplifier with 6 db gain. 10 Watts input -- 40 Watts output. Relay switching. Case included (same as PA1501H)

HIGH POWER RF AMPLIFIERS

Power boosters for 2 meters, Class C using balanced emitter transistors for long life and high SWR protection. For FM mobile or fixed operation.

- **All solid state**
- **strip line design**
- **Broad band**
- **High efficiency**

PA140/10 5-15 watts in for 100-150 watts out @ 13.6 volts
Typically 140 watts for 10 watts in

PA140/30 15-40 watts in for 100-150 watts out @ 13.6 volts
Typically 140 watts for 30 watts in

POWER GAIN: PA 140/10. . . .12DB PA 140/30. . . .7DB

INPUT POWER: PA 140/10. . 5 to 15 watts PA 140/30. .15 to 40 watts

INPUT VOLTAGE: 12 to 14 volts DC negative ground

NOMINAL INPUT CURRENT: PA 140/10. .22 Amps
PA 140/30 . . 18 Amps

STANDBY CURRENT: Virtually insignificant

INSERTION LOSS: Less than 1 DB on receive

DUTY CYCLE: 50% or less

RF sensing relay switched

DIMENSIONS: 7" x 10-1/2" x 2-7/8"

WEIGHT: 4 lbs.

UP TO 150 WATTS OUTPUT

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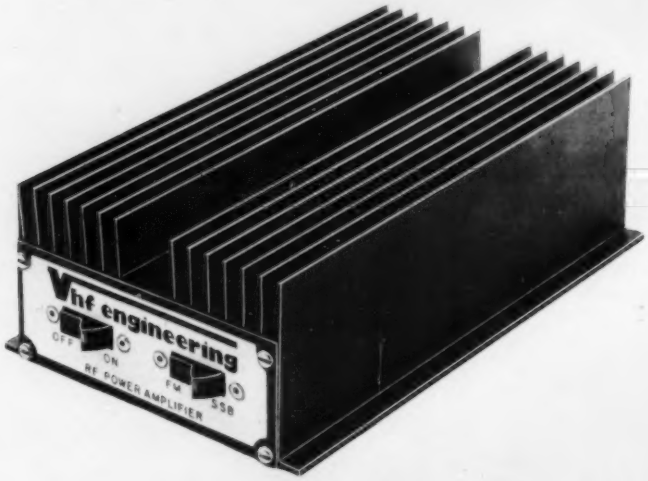
BLUE LINE HIGH POWER RF AMPLIFIERS



Don't sacrifice maximum power output and high efficiency for linearazation. The BLUE LINE offers you the best of both designs. The BLUE LINE amplifiers are engineered using the latest state of the art stripline technology. This design technology means efficient broad band output with a very high degree of mechanical stability.

Vhf engineering is the only name you have to remember when it comes to VHF or UHF amplifiers, just look at the variety available.

FEATURES

- High efficiency means low current drain.
- Broad band design (no tuning).
- Direct 12 volt DC operation.
- Indicator lamps for On/Off and FM/SSB.
- Relay switching (allows you to put amplifier in or out of circuit at the flip of a switch).
- Insertion loss of less than 1 dB.
- One year limited warranty on parts and labor.

MODEL	FREQUENCY	EMISSION	POWER INPUT	POWER OUTPUT
BLB 3/150	45- 55MHz	CW-FM-SSB/AM	3W	150W
BLC 10/70	140-160MHz	CW-FM-SSB/AM	10W	70W
BLC 2/70	140-160MHz	CW-FM-SSB/AM	2W	70W
BLC 10/150	140-160MHz	CW-FM-SSB/AM	10W	150W
BLC 30/150	140-160MHz	CW-FM-SSB/AM	30W	150W
BLD 2/60	220-230MHz	CW-FM-SSB/AM	2W	60W
BLD 10/60	220-230MHz	CW-FM-SSB/AM	10W	60W
BLD 10/120	220-230MHz	CW-FM-SSB/AM	10W	120W
BLE 10/40	420-470MHz	CW-FM-SSB/AM	10W	40W
BLE 2/40	420-470MHz	CW-FM-SSB/AM	2W	40W
BLE 30/80	420-470	CW-FM-SSB/AM	30W	80W
BLE 10/80	420-470	CW-FM-SSB/AM	10W	80W

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SYNTHESIZER II
A 2 METER FREQUENCY SYNTHESIZER

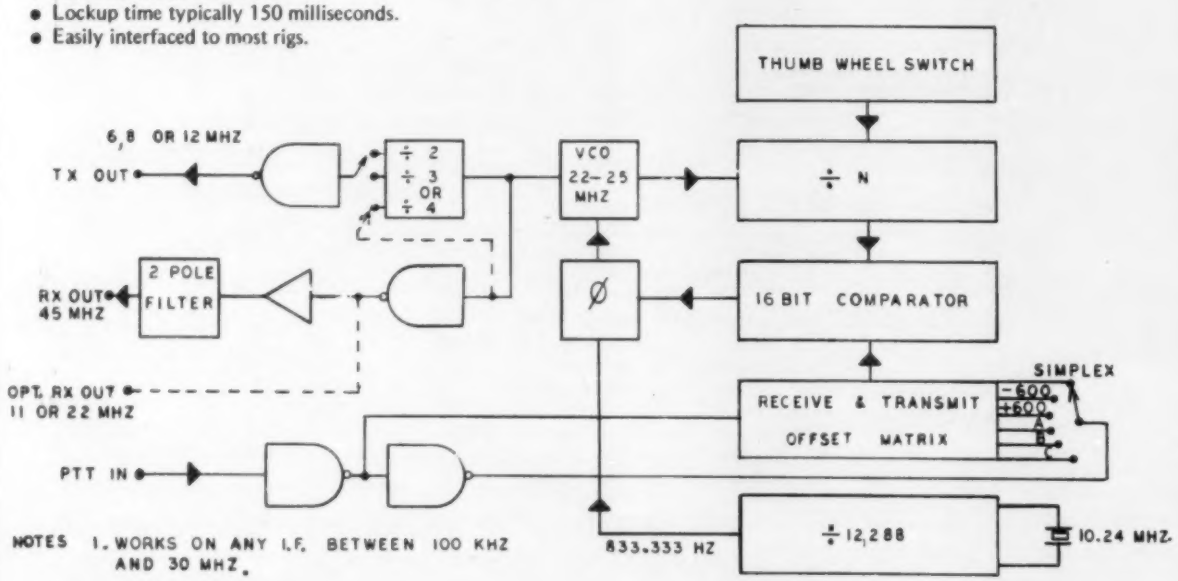
The Synthesizer II is a two meter frequency synthesizer.
Frequency is adjustable in 5 KHz steps from 140.00 MHz to 149.995 MHz with its digital readout thumb wheel switching. Transmit offsets are digitally programmed on a diode matrix, and can range from 100 KHz to 10 MHz. No additional components are necessary!

FEATURES

- T^2L Logic
- Maximum offset versatility—easily programmed to any IF and transmitter offset between 100KHz and 30MHz in even 100KHz increments (simple MARS modification available).
- Simple jumper wire change enables use on rigs with 6-8 or 12 MHz transmit crystals.
- All frequencies locked to one master crystal oscillator.
- 2 pole output filter on receive line.
- Virtually no measurable difference in spurious outputs between crystal or SYN II.
- Lockup time typically 150 milliseconds.
- Easily interfaced to most rigs.

SPECIFICATIONS

- Frequency: 140.000 149.995 MHz
- Transmit offsets: Simplex, +600KHz, 600KHz plus 3 additional field programmable offsets.
- Output: 3 volts to a 50^ load
- Input voltage: 11 18VDC at .900 amps
- Size: 8" long x 5½" wide x 2¼" high
  20.32CM x 13.97CM x 5.715CM
- Complete kit including all electronics, crystal, thumb wheel switch, cabinet, etc.



*Interface sheets available for most transceivers.

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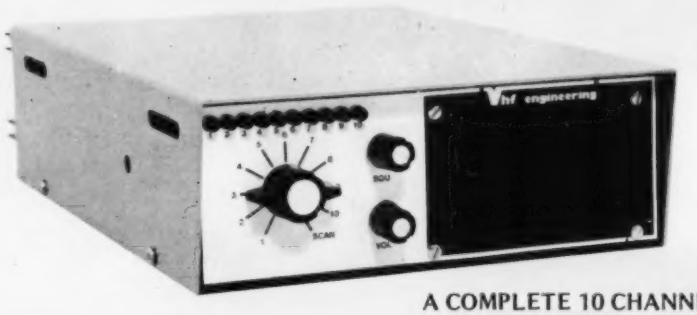
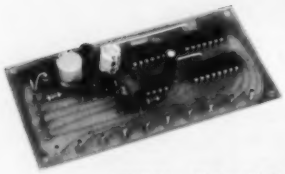
TRANSCEIVER AND ACCESSORIES



TRX-50
TRX-144
TRX-220
TRX-432

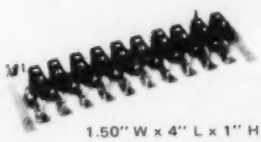
A COMPLETE 10 CHANNEL SCANNING TRANSCEIVER.
(Less mike and crystals)



1.25" W x 4" L x 2" H

SC3 SCANNER

THE SC3 10 CHANNEL SCANNER WITH PRIORITY CHANNEL IS DESIGNED TO BE USED WITH OUR CD1 OR CD3 (UHF) CRYSTAL DECK. IT MAY ALSO BE USED WITH ANY RECEIVER IN WHICH ONE SIDE OF THE CRYSTAL IS AT RF GROUND. OTHER CIRCUIT CONFIGURATIONS WILL REQUIRE MODIFICATION OF THE OSCILLATOR CIRCUIT IN ORDER TO ACHIEVE PROPER OPERATION OF THE SCANNER. THE SC3 REQUIRES A LOGIC 0 TO STOP THE SCANNING FUNCTION.



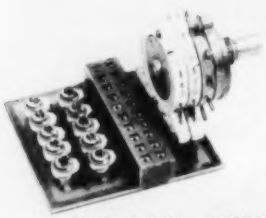
1.50" W x 4" L x 1" H

CD1

THE CD1 IS A 10 CHANNEL RECEIVE CRYSTAL DECK WHICH IS DIODE SWITCHED. IT WAS DESIGNED TO INTERFACE WITH THE CD2 BY ITSELF OR IN CONJUNCTION WITH THE SC3.

CD2

THE CD2 CRYSTAL DECK IS DESIGNED TO PROVIDE MULTICHANNEL OPERATION FOR THE TX SERIES TRANSMITTERS. IT FEATURES AN EXTRA SET OF CONTACTS THAT MAY BE WIRED TO THE CD1 OR CD3 CRYSTAL DECK FOR 10 CHANNEL TRANSCEIVE. THE EXTRA POSITION MAY ALSO BE USED TO SWITCH L.E.D. INDICATORS. THE SWITCH HAS 11 POSITIONS. THE ELEVENTH POSITION IS PROVIDED TO ACTIVATE THE SC3 AUTO SCAN MODULE. EACH CRYSTAL HAS A TRIMMER FOR NETTING.



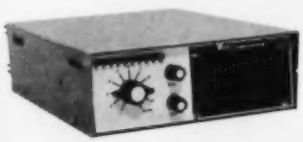
2" W x 3.25" L x 1.50" H

CD3

THE CD3 IS THE SAME AS THE CD1 EXCEPT IT USES LOW LOSS PIN DIODES. THIS DECK IS NEEDED FOR 432MHZ EQUIPMENT.

TRC1

PRE DRILLED & PUNCHED CASE ONLY



7.75" W x 11" L x 3" H

TRC2

THE TRC2 IS A PREDRILLED AND PUNCHED CASE TO BE USED IN CONJUNCTION WITH OUR TX, RX, CD1, CD2, SC3, AND PA MODULES. THE TRC2 INCLUDES ALL ACCESSORIES NECESSARY TO INTERFACE THE MODULES. VOLUME AND SQUELCH CONTROLS, KNOBS, SPEAKERS, GRILL CLOTH, ANTENNA CONNECTORS, TR RELAY, 10 L.E.D.'S, PULL-UP RESISTORS, MOUNTING HARDWARE AND BASIC PLANS.

MICROPHONE

2,000 OHM DYNAMIC MIKE WITH P.T.T. AND COIL CORD.

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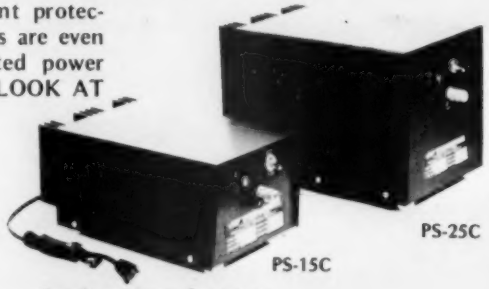
PS-15C, PS-25C and PS-25M POWER SUPPLIES

PROTECT YOUR EQUIPMENT. Full voltage and over current protection! Now our best selling high current amateur power supplies are even better. The PS-15C and PS-25C are well filtered and regulated power supplies. Top quality components insure optimum reliability. LOOK AT THESE FEATURES:

The PS-25M is the same as PS-25C with added output voltage and current meters.



PS-15C SPECIFICATIONS

Voltage Output:
adjustable between 12-14V
Load Regulation:
2% from no load to 10 amps
Current Output:
15 amps intermittent (50% duty cycle)
10 amps continuous

Ripple:
50 mV at 10 amps
Weight:
13 pounds
Size:
11-1/4" x 5-1/2" x 4-3/4"

PS-25C SPECIFICATIONS

Voltage Output:
adjustable between 10-15V
Load Regulation:
2% from no load to 20 amps
Current Output:
25 amps intermittent (50% duty cycle)
20 amps continuous

Ripple:
50 mV at 20 amps
Weight:
22-1/2 pounds
Size:
12-1/4" x 6-3/4" x 7-1/2"

Look at these features:

- Over-voltage protection crowbar.
- Electrostatic shield for added transient surge protection.
- A foldback output limiter operates for loads outside of the operating range.
- Isolation from ground. The circuit is isolated from the case and ground.
- 115/220 volt input – 50/60 cycle.
- Units are factory wired for 110 volt AC, 50/60 cycle power. A simple jumper will reconfigure the input for 220 volt AC, 50/60 cycles.
- Temperature range – operating: 0^{0} to $+55^{0}$ C.
- Black anodized aluminum finish.

PS-3012 POWER SUPPLY

A commercial version of the PS-25C with twin heat sinks for heavier duty and higher ambient operation.

SPECIFICATIONS

OUTPUT VOLTAGE	Adjustable, 11-15 VDC
OUTPUT CURRENT	30 amps maximum
REGULATION	Better than 2 percent
OUTPUT RIPPLE	50MV pk-pk maximum
TEMPERATURE RANGE	0^{0}-60^{0}C operating
OVERVOLTAGE PROTECTION	Built in OVP crowbar
OVERCURRENT PROTECTION	Foldback current limiting at 30 amps
SHORT CIRCUIT CURRENT	2 amps maximum
INPUT VOLTAGE	105-120 or 208-230 at 50-60Hz
SIZE	13¼" L X 7 1/8" W X 6 5/8"H
WEIGHT	25 lbs.
FINISH	Black anodized aluminum

Vhf engineering
320 WATER ST. / BINGHAMTON, N.Y. 13901 / Phone 607-723-9574

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PS 3012 – 30 lbs.
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Current-Saver Counter Display

-- multiplex those LEDs!

Bob Hart K7YGP
622 West 4th St.
Medford OR 97501

Probably one of the greatest difficulties in building a counter or anything else that has a digital display is providing the large amount of current necessary to run the display and drivers. The easiest way to minimize this problem is to turn on only one digit at a time in a sequential fashion at a rate fast enough to eliminate flicker. If the duty cycle is low enough (ON time small in relation to OFF time), no current limiting resistors are needed in series with the digit segments. Without series resistors, there is less power wasted in heat, so power requirements are less.

Back in the December, 1976, *73* (p. 140), WA1UFE wrote an article describing (among other things) how he reduced the total current requirements of the LED display in his counter by sequentially strobing the individual display digits. His circuit is shown in Fig. 1. A 7492 binary counter (or a 7490 decade counter with no feedback) connected as a divide by 10 counter is continuously clocked by a 1 kHz signal from his counter time base. Each of the 10 counter states is decoded by a 7442 1 of 10 decoder and used to turn on a PNP switch transistor connected in series with the anode of each 7 segment LED digit. This results in each digit being turned on for 10 per cent of the time at a 100 Hz rate. Notice that there are no dropping resistors in the circuit. The only limits to current flow are the switching transistors, the driver IC, and the LEDs themselves. This allows most of the supply voltage to be dropped across the LED resulting in excellent efficiency.

Well, all this is good, but as far as I'm concerned it doesn't go quite far enough. If the LED display is the most power hungry component in a counter, its drivers (7447) come in a good second. Each one of those little beasts consumes at least 265 mW. (In comparison, a fully lighted 7 segment display dissipates around 420 mW, a 7490 about 160 mW, and a 7475 approximately 160 mW.) With eight 7447s driving eight digits (as in the WA1UFE counter) that's a total of at least 2.1 Watts

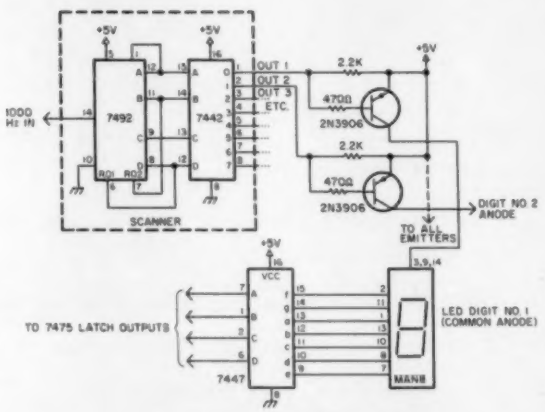


Fig. 1. WA1UFE display strobe.

(424 mA at 5 V). That turns out to be a fairly large contribution toward heating your shack (at least for a solid state device!).

So what can be done about it? There has to be some way to tell the LED which segments to display for which numeral. Ah-ha! he says. Since, when strobing, only one digit is on at a time, why not decode the 7 segment drive one digit at a time? This way you can be rid of the power load of all but one decoder/driver. Again, in the case of the WA1UFE counter, this would reduce the driver power requirements by a factor of 8. Following are two ways this could be done. The first is for the person who has already constructed a display system and doesn't feel like tearing it down and starting over. The second is for new designs and has the added advantage of being less expensive — only one 7447 is needed for the entire display.

The system for the existing display is merely a modification of display strobing. When a digit has been turned off by the strobe circuitry (which is 90 per cent of the time), its driver is just sitting there twiddling its open collector outputs. So why not turn it off too? This can be done by switching the 7447 Vcc in the same manner as was done for the LED anodes (see Fig. 2). If you are already strobing your digits, the driver as well as the digit can be strobed by reconnecting the PNP switching transistors to the individual 7447 Vcc pins. The LED anodes are then connected directly to the 5 volt bus. If you feel the display is too bright, an easy way to halve the brightness is to connect pin 4 of the 7447 (blanking input — called the BI/RBO node in the literature) to the 1 kHz signal that drives the strobe counter. Whenever this signal is low (and it's low half the time that any digit is on) the 7447 output is blanked, resulting in a 5 per cent (rather than 10 per cent) duty cycle. As shown in the schematic, the line driving the blanking inputs should be buffered by 7404 inverters since the BI/RBO node represents a load three times that of a normal TTL input (now why did they go and do that?). One inverter should be capable of driving three blanking inputs. Three buffers (inverters) are needed to drive the eight digits of the counter. Using this circuit with a MAN 1 display, the average segment current is about 8 mA (5 per cent duty cycle) giving brightness sufficient for a brightly lit room. With no signal driving the blanking input, segment current is 16 mA average and results in a very bright display.

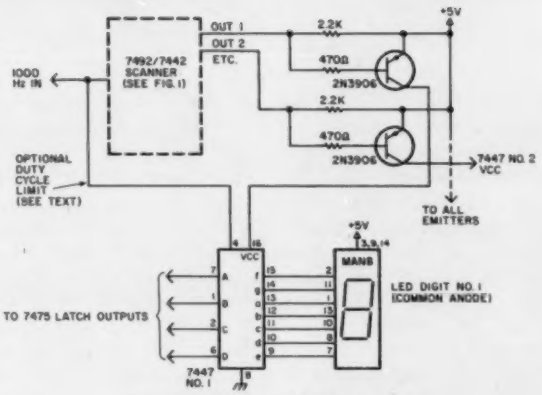


Fig. 2. Display and driver strobe.

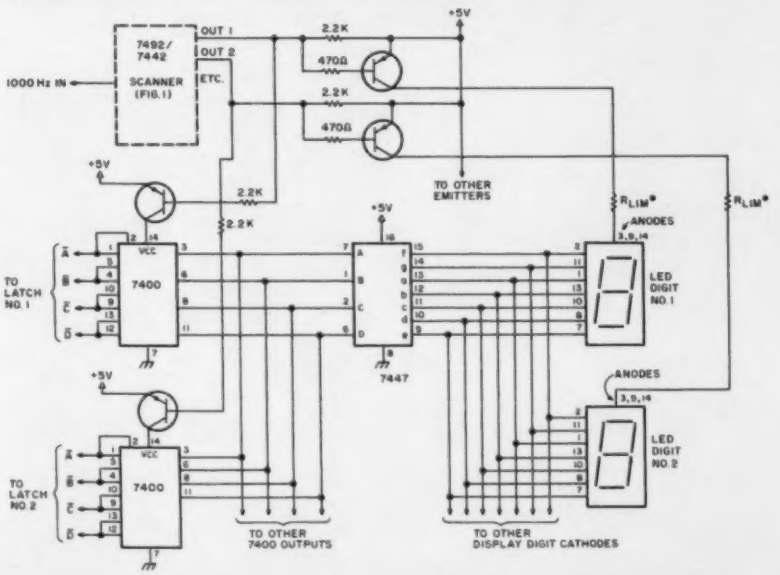
Starting from Scratch

This section is not required reading unless a) you enjoy modifying projects that are already working fine, b) you think it's time to start a new design, c) you wonder when the heck I'm going to say something about multiplexing, or d) you want to put off taking out the garbage for a few more minutes. A little thought about the last described circuit shows that since only one 7447 is used at a time, only one should be necessary for the entire system! All that is needed is a way to switch the 7447 to each BCD output and each 7 segment LED in sequence. This switching system (called a multiplexer!) is not as difficult to accomplish as it sounds. The PNP switches that were used in the original strobe system are now reconnected to the digit anodes and all of the like segment cathodes are connected in parallel (a to a, b to b, etc.) to the outputs of the 7447. This effectively connects one digit at a time to the 7447 driver.

In order to switch the BCD inputs from the 7475 latches, I will resort to a trick that will undoubtedly cause a few designers to cringe. It does not follow the teachings according to Texas Instruments, but it does work. Anyway, each BCD coded signal is applied to the inputs of a 7400 quad NAND and all the like outputs of the several 7400s are wired together. Data switching is accomplished by turning on the Vcc to the desired 7400. The complete multiplexed display system is shown in Fig. 3.

Unfortunately, this circuit will not work for all displays. The problem is that the out-

Fig. 3. Multiplexer for common anode LEDs. All transistors 2N3906 or equivalent. Note — inputs to F400 multiplex switches are inverted data.



put of the 7447 can only sink 20 mA per segment. This means that if you have 8 digits the average current per segment cannot exceed 2.5 mA. The resistors (sorry) in the segment lines serve this current limiting purpose. This would probably work fine for the smaller displays or possibly the newer high efficiency types (HP 5082-7650 – I don't know where to get them). For complete flexibility, the segment driver should be able to sink a maximum of 200 mA. That would allow ten digits at 20 mA per segment. The obvious way to do this is to add external transistors to the segment driver lines. An additional disadvantage to this is that this circuit will only drive common anode LED displays. Take a look at the ads in the back of this *73* and you will find that the inexpensive displays that were originally designed for calculators, clocks, and multiplexed operation are almost all common cathode types.

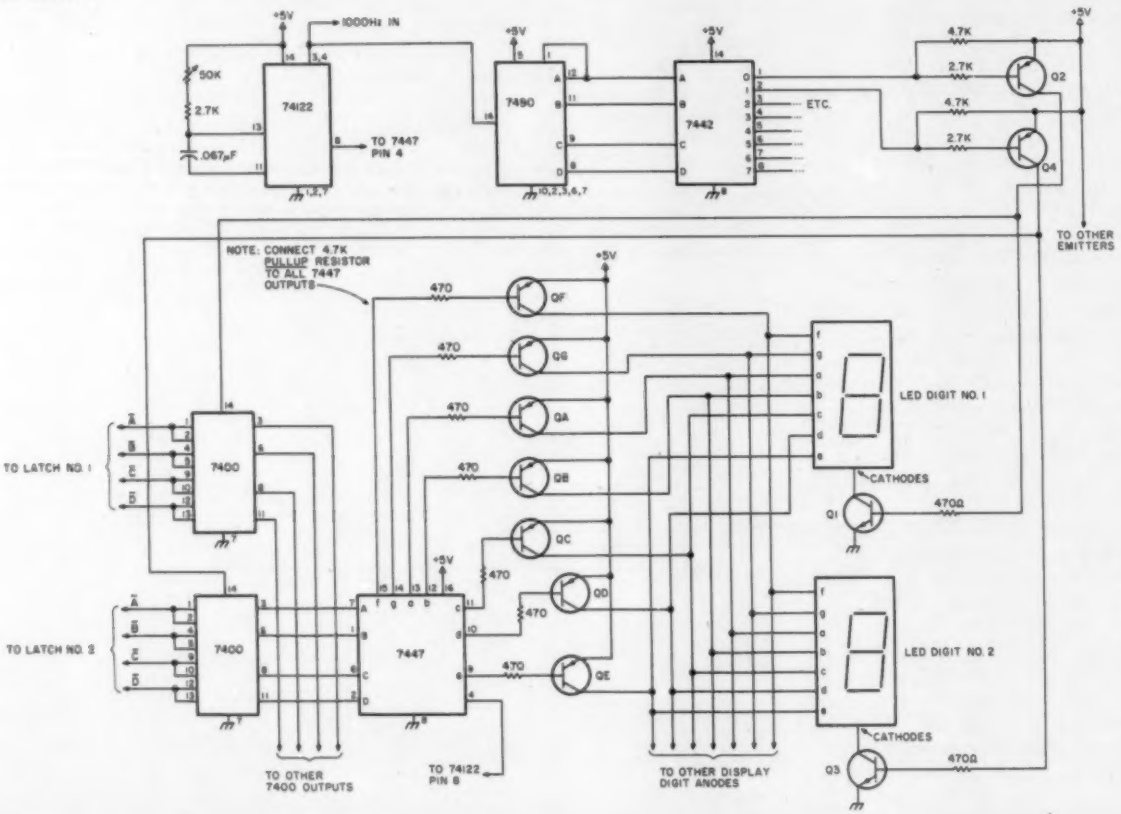
Since we are starting from scratch in this section, we might as well design the final display driver for common cathode displays. It should also be capable of driving up to 10 digits at 20 mA per segment (look at Fig. 4). One additional feature is a one shot (74122) tied to the blanking input of the 7447. This allows variable display intensity by changing the amount of time the digits are strobed on. Duty cycle of each digit can be varied from 10 per cent (full blast) to less than 1 per cent (almost off). If you don't want all this versatility, then leave out the 74122 and connect the blanking input to the 1 kHz clock as previously described. The rest of the circuit is just an expansion of the previous circuits. A 7490/7442 1 of 10 multiplex driver is used to strobe the display digit cathodes (through Q1, Q3, Q5, etc.) and at the same time turn on the required 7400 multiplex gate (through Q2, Q4, Q6, etc.). An important point is that the 7400 gate inputs are connected to the $\overline{Q}$ outputs of the 7475 where normally data is taken from the Q outputs. This is done because the 7400 inverts signals applied to its inputs. If no inversion can be tolerated, use a 7408 (same pinout but is an AND gate rather than a NAND gate) as the multiplex gate. It will work the same as the 7400 except that the data will not be inverted.

Because we are using common cathode digits, the outputs of the 7447 are polarity inverted by Qa, Qb, Qc, etc. Transistors Qa, Ab, etc., and Q1, Q3, etc., should all be capable of conducting 200 mA continuously (to be on the safe side). For the PNP types (Qa, Qb) a Sylvania ECG 159 or a Motorola HEP would work well. An ECG 123 or HEP S0002 are ideal transistors to use in the Q1, Q3, etc., slots. Q2, Q4, etc., can be any silicon PNP transistor. Actually, you could probably use any silicon transistors of the proper polarity you happen to have for any of the devices. Give them a try – if they get too hot to touch, try something else.

The End

There are a few more ways to light a display besides just connecting a 7 segment LED to the tail end of a 7447. While the other methods make things a bit more complex, some of those help control your electric bill and others can reduce your parts bill. So use one of these systems in your next (what the heck – rip that new counter apart) project. If anyone asks, you'll be in a position to bore them at length about the marvels of multiplexing. ■

Fig. 4. Multiplexer for common cathode LEDs. See text for transistor types. Inputs to F400 multiplex switches are inverted data.



Chaz Cone W4GKF
53 Old Stone Mill Road
Marietta GA 30067

Instant QSO Recall System

- - gaining peer respect

Notice the choice of the word "gain" rather than "earn" in the title of this piece. What I'm going to tell you about will dazzle and amaze your friends – and hams all over the world. The technique is easy to implement, costs very little, and satisfies a craving deep within some of us to continually be "one up" on everyone within earshot (or receiver-shot).

I've been a radio amateur for nearly 25 years, and I can tell you the name, QTH, and other interesting information about anyone I've ever QSOed – and I can find the information in about four seconds or less.

Now, I work with computers every day, and I've been interested in microprocessors ever since I saw the first MITS ad – but if you're thinking of a QSO file application, I can beat any affordable machine technique for under $15.00.

Before I tell you this deceptively simple procedure, let me examine with you *why* someone would want to do this. Why would you want to store away and retrieve quickly information about radio contacts?

The reason *I* do it is that I get a boot out of coming back to a call with the caller's name, like: "Hi, Brad. How are things in Omaha?" It blows his mind, usually, and we end up discussing the system (and my phenomenal "memory"). And, of course, after 20+ years of doing this I just can't stop!

Most of us who care about such things have tried QSO filing systems and abandoned them. If you filled out a 3 x 5 card on every contact, you would soon have too many cards to warehouse, much less use to enable finding any particular contact quickly. And using a whole card is a waste of space and material (in addition to being ecologically unwholeseome). So what's the system?

My system, and I don't claim originality, requires that you purchase 676 file cards. I use 4 x 6 cards; you might want 3 x 5 or even bigger ones. You'll also need a box in which to put them and some alphabetic dividers. I bought all three items in a stationery store (at today's prices the total bill is about $14.00). Try to get dividers with mylar-reinforced tabs, and index cards with lines on at least one side.

With a pen or pencil (here's your chance to be creative) write "AA" in the upper right (or left) corner of a card. Make the letters comfortably large, since they should last a lifetime and your eyesight will not always be as keen as it is today – 3/8 to ½ inch high should do nicely. In the same way, put "AB" on the second card, "AC" on the third, and so forth. By the time you're through, the last card will be lettered "ZZ" and your writing hand will be *very* tired. I actually had my wife do this lettering; it kept her busy for a couple of hours and she didn't spend a dime during that period – maybe I've got something here after all.

Take a break, solder all connections to this point, and relax. Admire your handiwork (or your wife's). Insert the dividers into the deck of cards in front of each group, so that there are 26 cards behind each divider. See how symmetrical it all is? Psychologists say that symmetry is gratifying.

There's your instant-access QSO file. It will hold more than 20,000 QSOs, and you'll be able to find any one of them in less than four seconds. *And*, it will never occupy more space than it does right now.

I put one QSO per line on each card as I work a new station. I record callsign, name, QTH, date, band and whether a QSL was sent/received (a checkmark for a QSL sent, a circle if one is received). There is additional room for other info if you wish, and, if there is a lot you want to write about a specific contact, you can put an asterisk on the line and write paragraphs on the back of the card.

Hold it! Which card does a QSO go on? I put the contact on the card that matches the *last two letters* of the callsign. I chose the *last* two instead of the first two, because this gives a more normal distribution; in many DX countries you will find callsigns grouped heavily toward the front of the alphabet. See how it works? As an example, my "KF" card has everyone on it that I've ever worked whose call *ends* in "KF": W 7 G K F, E A 3 R K F, WB6NKF, and so forth. I would be on *your* "KF" card.

That's all there is to it. When I hear a CQ (or call one), I can locate the right card as soon as I hear his callsign, determine if we've talked before, and come back with his name in practically no time. If it's a first contact, I fill out his line during the QSO. You've got room on a 4 x 6 card to put comments like: "photography," "cars," "DX," and so forth on the line, so that you can recall his special interests on your next QSO. If you are into Ten-X hunting, county hunting, DX chasing, or other subinterests, you can tell instantly whether this contact is a new one or not.

It's not much trouble to maintain (really!), and it's a great memory substitute.

Get yourself a box, 676 4 x 6 cards, and a set of alphabetic dividers, and snow your friends! ■

W. J. Prudhomme WB5DEP
1405 Richland Ave.
Metairie LA 70001

New PC Techniques Unveiled !

-- dig out your old chemicals

Regardless of how you go about it, etching printed circuit boards can be a chore unless you happen to be making them commercially on a continual basis. After all, when the artwork is complete for the first board, making additional boards is not all that difficult. The same is true for any other type of printing process – the first page is always the most expensive.

However, if you are like most hobbyists, you are not interested in making 50 to 100 identical PC boards. Usually, you are interested in building one circuit at a time. This leads us to the basic problem faced by all hobbyists today – it takes as much effort to make that one PC board for your favorite project as it does for a manufacturer to make fifty.

For this reason, printed circuit boards for the casual builder of electronic projects have become both a solution and a problem. They are a solution to reducing the time it takes to wire a circuit *after* the board is etched. They are a problem due to the time that it takes to etch the board in the first place. They are a solution to minimizing wiring errors – after the boards are etched. They are a problem in that an error in the artwork will be duplicated in all boards etched from the original artwork. In this case a small error in the beginning is multiplied by the number of boards etched.

In this article, we will review some advantages and disadvantages of PC boards, various techniques available today, a few application guidelines, and the recently introduced "Stamp It & Etch It" product. Let's begin with some disadvantages of PC board construction.

Disadvantages

Printed circuit boards (or the etching of them) can be a big bugaboo in any circuit builder's life. If you have etched boards before, you already know why this is so. In many instances, you may have discovered that it takes much longer to etch the board than it does to mount and solder components on it. While you were making that discovery you may also have concluded another characteristic of making circuit boards: Depending on the technique you use, it may take just as long to make one as it does to make 5 or 10. Why? Well, whether you are making 1 or 50, you must first prepare the preliminary layout, plan the location of components, make the final artwork, and, depending on the process used, prepare a negative or positive film.

Up until this point, the required time is the same regardless of the number of boards being made. The next steps involve exposing and developing the PC blanks, and finally etching the boards themselves. If you have the facilities, it may be possible to etch several boards in one tank. This mass production is the main advantage to using PC boards in the first place. For the average hobbyist, however, the advantage of mass production has little value, since many of our projects usually involve only one type of board at a time.

Also, if you are not fortunate enough to have a special place set aside to make PC boards, another disadvantage becomes obvious. Each time you want to make a board, it is necessary to set up equipment, being careful of chemical spills and then putting everything away when the project is completed.

This can sometimes be very annoying, to say the least. Especially when you accidentally change the color of your kitchen countertop with a little ferric chloride.

Some Advantages

But before I paint too bleak a picture of PC board techniques, what are some of their advantages? I've already mentioned that once they are etched, PC boards can save you much time in wiring a circuit – in addition to minimizing wiring errors. Also, once you have perfected a layout and worked the bugs out of a critical rf circuit, the results can be duplicated by anyone following the same layout.

For prototypes and one of a kind projects, PC boards can also be very useful. In most of these applications, the film process is usually bypassed by making the layout directly on the copper blank (using dry transfer, resist pen or tape). This technique can save much time in getting your circuit from the "paper" stage to a finished product.

In addition, new tech-

niques are continually being developed to make it easier for the hobbyist to build electronic devices. One new development is the "Stamp It & Etch It" technique, which will be evaluated later in the article. This kit is actually a set of rubber stamps consisting of TO-3 pads, IC pads, component and edge connector fingers. But, I'm getting ahead of myself. More on this later.

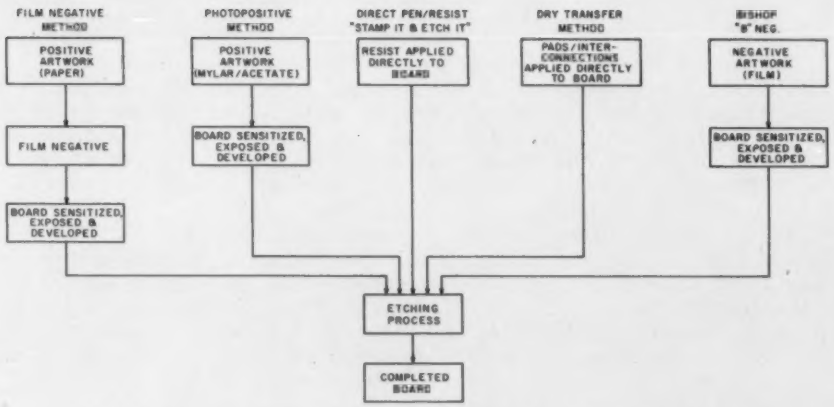


Fig. 1. Block diagram of the steps required for each method.

Present Practices

There are several ways to make PC boards today. To name a few of the present methods: direct pen resist/etch, dry transfer, film negative, photopositive, Stamp It & Etch It, and the patented Bishop Graphics method called the "B" Neg drafting system. See Fig. 1 for a diagram of these methods.

1. *Direct pen resist.* This is perhaps the most basic technique and, for simple circuits, is probably one of the easiest to apply. Once you have made a preliminary layout sketch of the PC pattern, you simply transfer it to a clean PC blank with a "resist pen." This is a felt-tipped type pen containing a heavy lacquer that is unaffected by the ferric chloride etching solution. When the copper board is placed in this solution, the copper is removed wherever it is not protected by the lacquer. In effect, the lines drawn by the pen are the actual circuit conductors on the completed board.

2. *Dry transfer method.* In this technique, pressure-sensitive pads and tapes representing terminals and connections are used. Once the layout has been drawn on paper, it can be transferred to the copper blank using carbon paper and retracing the lines. An alternate method is to draw the circuit in pencil directly on the copper board.

Next, the pattern is protected by applying dry transfer pads to the appropriate areas on the copper surface. These pads usually come in sheet form and are transferred to the copper surface by rubbing them off the sheet with an old ball-point pen that no longer writes. Then the conductor paths are made using tapes of various widths, depending on the circuit requirements. From this point on, the board is etched in the usual manner.

A variation to this method is to tape the board completely with wide masking tape. Then cut out the taped areas where you want to etch the copper away. The remaining masking tape will protect the copper from the etching solution. This method is particularly useful in rf circuits where large ground plane areas of copper are desired.

3. *Film negative method.* This is the standard in the electronic industry, since it provides extreme accuracy and high density of complex circuits. There are various types of drafting aids available for many applications. For example, there are tapes, tape shapes, donut pads, die cut multipad figures (for transistors, integrated circuits, etc.), connector strips, and many more. These pressure-sensitive drafting aids come in the standard sizes of 1:1, 2:1 and 4:1.

Here's how to use them. Start with a sheet of drafting paper with 0.1" grid lines. After you have drawn your layout to the scale desired, lay a sheet of Mylar™ or clear acetate over the pencil copy. With Mylar, I find it better to place the frosted side up – since you can easily write on this surface.

The next step is to transfer the pressure-sensitive pads to the correct places over your pencil layout. To remove small patterns from the backing, slip the blade of an X-acto™ knife under the pattern and lift it off. Then, using the knife blade as a holding tool, position the adhesive pattern over the artwork. If you happen to get the pattern positioned wrong, just slip the knife blade under it, lift it and re-position it. Once the patterns have been placed, a special black tape is used for interconnections.

We now come to the photographic step. If your layout is a 1:1 scale, you can make a contact negative using sheet film. This is recommended only for photography buffs who have their own darkroom. If you don't have a darkroom, the easiest thing to do is bring it to a photographer or a drafting/reproduction house and tell them what you want. The usual charge for making a negative is two to three dollars. If the scale of your artwork is other than 1:1, it will be necessary to have the negative reduced appropriately.

Once you have a negative of the circuit, it will be necessary to transfer the image to the copper blank. First, the copper is "sensitized" with a special chemical, usually in a spray can form. This is usually done in subdued light for photographic purposes. The coating must be uniform and dried for a period of time. Complete instructions for this process comes with the chemicals you buy, so we won't go into great detail here. The remainder of the process includes exposing the sensitized board with the mask over it, and developing the pattern. Then the board is etched in the usual manner.

Even in my abbreviated and once-over-lightly discussion of the steps involved, the whole process seems a bit complicated for most weekend projects. Then, when you consider the two to three hour process time, it seems there must be a better way. Many people I have talked to are turning more and more to local, commercial PC fabricators. But here again, cost may become prohibitive. Our local PC house charges around $5 or $6 for a 4" x 6" board. In many instances, the board costs as much as all the components that go on it. Is there an easier way?

4. *Bishop "B" Neg drafting system and the photopositive method.* Both of these methods have the advantages of eliminating the photo process of developing a film negative, but as a result they are suitable for 1:1 artwork only.

Basically, the Bishop "B" Neg method produces nega-

tive artwork which is used with a negative photoresist. By working with negative artwork directly, there is no need to have a film negative made – thus saving you time and money. Another advantage to this system is that it can be changed at any time without the expense of having a new film negative processed.

Additional information on this method can be obtained from: Bishop Graphics, Inc., 20450 Plummer Street, Chatsworth CA 91311.

An alternate method with similar results is the photopositive method. A positive resist has been developed that operates in reverse from the standard negative resist. Once your board has been sensitized with this positive photoresist, you can use positive artwork on Mylar or acetate film directly to expose the copper blank. In addition, no highly volatile hydrocarbon developers are needed as with the negative resist. Instead, only ordinary household diluted lye (sodium hydroxide) or caustic soda in water is used as a developer for the positive photoresist.

As with the Bishop "B" Neg system, changes may be made on the positive artwork without having to go to the expense of the photographic process.

Although there may be other suppliers of positive acting photoresist products, one company I am familiar with is Trumbull, 833 Balra Drive, El Cerrito CA 94530. They have a complete line of artwork aids, drill bits, and copperclad boards, and they spoil the hobbyist with prompt shipments.

5. *Stamp It & Etch It.* Always looking for new and easier techniques, I noted an ad one day for ACE Laboratories (now Rainbow Enterprises, PO Box 2366, Indianapolis IN 46206). What really caught my eye in the ad was the statement, "... reduces printed circuit board artwork from 2 hours to 10 minutes ..." This statement and the fact that the kit is offered on a satisfaction guaranteed basis was enough for me to send them $10.00 to find out what it was all about.

A few weeks later, I received my package and was anxious to open it up. This is what the kit contains:

(1) Individual rubber stamps consisting of PC board connector fingers, 16-pin dual in-line IC socket, 10-pin round, 8-pin round, TO-5, TO-18, large/small donut pad;
(2) Resist ink (small bottle);
(3) Ink pad;
(4) Resist pen (felt marker type);
(5) Etching containers (plastic bags).

Making a PC board with this method eliminates the preliminary artwork and photography. You merely stamp the component patterns directly on the PC board, use the lacquer pen to connect the components, and then etch the board. I used this basic method to etch a board containing 13 ICs, and the results were fairly good. However, as always, there are a few precautions that can be taken to insure that you obtain the results you are trying to achieve.

The usual preparations of the copperclad board should be made, such as a thorough cleaning to remove any dust, film or fingerprints. After the PC board is cleaned and dried, lay it aside and proceed to prepare the stamps. This is done by inking the pad sparingly with the lacquer supplied. Only about a 1" square area is required for most jobs. Trying to ink more than this will result in the pad drying out before you are finished with the board.

If you are using the stamps for the first time, ink them well and practice on a paper blotter. This is necessary in order for you to get the feel of the operation – and also to fill the pores in the rubber stamp material. When you feel confident in using the stamps, your next step is the PC board itself.

I found it difficult to place the stamp exactly where I wanted it on the board "free hand," without it sliding and smearing the ink. This problem was solved by using a small piece of wood (1" x 2", about 6" long) as a guide. Just hold the guide flat against the PC board with one hand, while you slide the rubber stamp against the guide until it rests flat against the copper surface.

Another variation to this technique can be used if you have several ICs in a straight row. Just temporarily clamp the guide and circuit board in a small vice along the line of the ICs. It's much easier to print each IC along the stationary guide, and you end up with all components in a relative straight line without too much effort.

The IC patterns seem to work out best. The first PC board I etched with this kit took more than the advertised ten minutes. However, the stamps do make it easier to etch a board.

They also have another feature which may have been overlooked. Before you begin to prepare a PC board for etching, it's usually necessary to prepare preliminary artwork. This is the process of determining component placement and interconnecting lines. I have found the rubber stamps invaluable for this phase of the process. In the preliminary circuit layout on paper, the stamps are used with an ordinary office-type ink pad. This is a great timesaver in producing professional-looking transistor and IC pin connections. This method is also much cheaper than using pressure-sensitive adhesive decals for the preliminary artwork. Bear in mind, however, that the stamps do have limitations and that the results depend to a great extent on how you use them. ■

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How Do You Use ICs?

- - part VII

Most of this series has been concerned with digital ICs. Just for a change of pace, here's one of the workhorse linear ICs – the LM380 series of audio power amplifiers.

There are two in the series: the LM380 (or LM380N), which is a two Watt power amplifier IC, and the LM380N-8 (or LM380CN), which is a 600 mW power amplifier in a minitype DIP (dual in-line package).

Besides the power difference, the pin connections are not the same, so we will take one at a time.

The first hurdle to get over is the power. It may not seem like much to talk about something which only puts out 600 mW or two Watts. This must be put into correct perspective.

Most amateur and communications type equipment usually has an audio power output in the neighborhood of one or two Watts. Even the much prized R390 or R390A only has a 600 mW output.

If that doesn't convince you, just think how loud those teensy transistor radios sound. Most of them are only about 100 mW or so. Make no mistake. These audio ICs are well within the useful range of audio output power for most purposes.

Both ICs can actually put out more power than these basic ratings, but this gets into problems with heat sinking and other special precautions. This series is devoted to the easy and reliable.

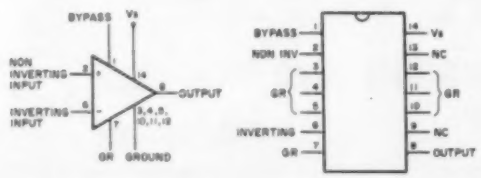


Fig. 1. LM380N 2 Watt audio amplifier IC.

Fig. 1[1] shows the pin configuration for the LM380(N) and the schematic symbol. This IC is in the 14 pin DIP configuration that has been commonly seen in this series.

Taken all by itself, the schematic representation of the device as a sideways triangle may seem a bit dumb. Once again we are faced with the problem that this is another computer symbol, the one for the amplifier function, which was retained for the device in other applications.

It is dumb, but it is what you are going to find on most of the schematics that use this and other IC amplifiers.

This means audio, i-f, rf, op and the works. They all use this same symbol, so watch the device number and the pin connections carefully.

This IC is another device with a minimum of external parts to go with it. There are a wide range of values that may be used depending upon the application though. Most are not critical, but you will have to understand how and why the choices were made.

Keep in mind that this device was intended for a number of purposes and has features that are not immediately applicable to the audio amplifiers you will be using.

It was designed to perform a number of audio jobs in intercoms, TVs, radios, tape recorders, etc., and for various control amplifier applications. Its use as a communications type audio amplifier is what we are interested in.

In order to simplify the circuit, it will be described in sections with the explanation of the associated parts.

Fig. 2 shows the IC and its usual output circuit. R1 and C1 are theoretically optional.

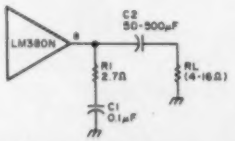


Fig. 2. LM380N output circuit.

They are there to prevent a 5 to 10 MHz oscillation which may occur with some types of operation.[2]

When bench testing the IC, they did help to prevent audio oscillation with some circuits. The values shown are the specific values to be used.

C2 is the output coupling capacitor. The low impedance output is capacitively coupled to the load. The voltage rating should be higher than the source voltage by a slight margin at the least.

The value is not critical for communications work. The typical range of values is from 50 uF to 500 uF. The basic effect is on the low frequency response. For hi-fi use you would want the larger value.

The LM380 will work with a load from four to 16 Ohms impedance. This gives you quite a bit to play with. There are plenty of speakers in this range and it will also work with your 8 Ohm ham headphones or a set of stereo phones.

The stereo phones can be hooked up as either a 16 Ohm load (series) or a four Ohm load (parallel). The advantage of using the phones as a four Ohm load would be that the shell of the plug could be grounded when the jack was chassis mounted. For 16 Ohm use, the jack would have to be insulated from the chassis.

There is slightly more output with the sixteen Ohm hookup, but not so much as to be critical. There will also be differences in the amount of actual audible output depending upon the efficiency of the speaker or headphones used. Still, the IC should be usable with almost anything standard you have on hand.

Fig. 3 shows the power, grounding, and bypass circuitry of the IC. Pin 14 is the Vcc source pin and pin seven is the nominal circuit ground. Notice that there are six other ground pins.

These are not because extra grounding was needed. Their specific purpose is to be part of the heat sinking mechanism. When used with a PC board, they draw heat off to the solid foil where it can be dissipated safely.

The IC is designed for use with a minimum voltage of 8 and a maximum of 22 volts; however, those tested would not work below ten volts source.

While not always shown, the Vs pin should be bypassed if the supply is more than a few inches away from the IC. It probably is a good idea to bypass it anyway. This is to prevent audio oscillation. The value is not critical, and for most audio uses, 0.1 to 10 uF is common.

The other bypass capacitor shown is also optional in some circuits. Its function is to bypass the supply to the internal small signal high gain sections of the IC where power supply hum or other noise can get in and be amplified.

There is an internal split load resistor for these stages which is bypassed to ground when extra decoupling is desired.

For audio circuits, this is usually desirable. Here the common value is in the 5 to 10 uF class, but it is not too critical. This does have an effect on the frequency response, but for audio use, there did not seem to be any appreciable difference with or without in the test circuits.

It probably won't degrade performance for communications work either. Use the bypass to take advantage of the extra decoupling.

We now come to the matter of power output. At the beginning of this article, the LM380 was listed as a two Watt amplifier. This presupposes that it gets the required drive and the rated source voltage.

With its full 22 or so volts, it will have that much output, but not with less source voltage. Here what seems like a decided liability actually works for you.

Most transistorized or IC amateur and communications type equipment is also designed for mobile use, specifically with a design center of the 13.8 volts or so that the normal car or truck will have. Nominally this is specified as twelve volt operation. This can make design work easier for you.

Instead of a wide range of operating conditions, you can expect the 12 to 13.8 volt range to be your norm. These test circuits were tested from 12 to 14 volts for actual operating characteristics.

This automatically uses the first rule of IC and transistor work: Don't push the ratings. The 14 volts is well within the rated voltage for the device and is a very safe margin. The big question is: What does it do to the actual performance?

Mathematically, you get quite a bit less output with less source voltage. When tested, it worked out to about 500 mW at best. This may not sound like much on paper, but in terms of real sound it is more than you want.

This will take some explaining. The output voltage through the capacitor is the signal voltage that drives the speaker or headphones.

This voltage is derived from the source voltage. The IC automatically centers itself at one half the source voltage and the output voltage swing is the source voltage minus the voltage differential required for the device to operate, usually several volts.

This means that the output voltage will be less than the source voltage by several volts. That is all there will be. You can drive the input up to the point where this maximum signal output voltage is used up.

Overdriving will result in distortion caused by the signal being clipped when there is no further output voltage swing available.

Not to worry. Just keep it in perspective. You can't hear a number. How does the IC sound? The IC was tested using the output from an FM tuner as the signal source. This is a more demanding signal than speech, as music shows up distortion much quicker and the acceptable distortion level is less.

Using a good quality speaker, a number of types of signals were tried, everything from acid rock to classical music. Rough measurements of the output to the speaker showed approximately 500 mW available without distortion. Slightly more power was available before distortion became unacceptable.

However, listening in the room the speaker was in was somewhat uncomfortable. It was too loud. In fact, it could be heard through much of the rest of the house. The room door had to be shut to continue testing.

At these power levels, that safety factor becomes quite an advantage. After several hours of continuous use at the maximum usable level at fourteen volts, there was no evidence of any heat problem. There is a built-in thermal overload circuit, but

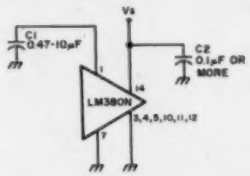


Fig. 3. LM380N power, bypassing, and ground circuit.

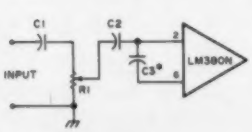


*Fig. 4. LM380N input circuit (*optional for tone).*

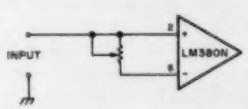


Fig. 5. Common mode volume control.

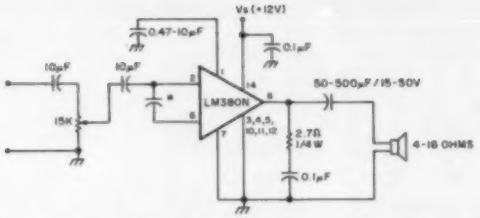


*Fig. 6. Full schematic, LM380N audio amplifier. *See text.*

the device did not even feel warm to the touch.

For enjoyable room listening, much less power was needed. 30-40 mW would fill the room. There was one slight problem at that power. The base response suffered. For communications work this would not even be noticed, but with music it was noticeable.

This may not be a fault with the IC or circuit though. None of the components were really chosen for hi-fi response. As the volume control was almost all the way down, the low resistance across the IC's input may have caused the loss. It is more likely that at the low power level there was simply too little drive to the speaker at low frequency.

This is a problem with any speaker. It takes more power to drive them well at low frequencies. This usually means poor response unless a base boost circuit is used. This would be uncommon and unnecessary for communications use.

The input circuitry of this IC is the hardest part to understand, but not to use if you know what you want.

There are two inputs, one inverting and one non-inverting. They do just what the name implies. For audio use the non-inverting input is commonly used. But what to do with the other? There are several options because the device was intended for many types of inputs.

The unused input can be left floating, grounded through a resistor or capacitor, or grounded directly. The application notes give the particulars for other uses; what we want are the standard receiver audio section type answers.

In this case, the usual procedure is to leave the inverting input floating or ground it directly. The audio input goes to the non-inverting input, pin two.

This is shown in Fig. 4. C1, C2, C3, and R1 are not critical, but do have an effect on the input, so a word of explanation is in order.

C1 and C2 are signal coupling capacitors. Their value is not critical. The voltage rating should be sufficient to block the dc voltage from the preceding stage from getting to the IC input.

The value affects the frequency response, the low frequencies in particular. For communications use, anything from 0.05 uF on up will do. For best low frequency response, a small electrolytic can be used. Values around 10 uF are common.

The high frequency response of the LM380 is quite good. In fact, the audio quality is rather brilliant. It is more high frequency response than is needed or usually wanted.

Most communications amplifiers are built to limit high frequencies, so there is usually the equivalent to C3 in most circuits. Even for music it sounds better to take out some of that brilliance and make a more natural sound.

The C3 value is not critical and is usually a matter of personal choice. A value of 0.005 to 0.05 uF would be the likely range.

In the schematic shown here, C3 is between pins 2 and 6. It can also go between pin 2 and ground. It made no appreciable difference if pin 6 was grounded or ungrounded. Grounding may be advisable in some circuits to avoid stray coupling to the input, particularly if the inverting input is used and the other is left unused.

Volume control R3 is not critical. The test circuit used a stray 15k Ohm volume control. It would seem likely that anything up to 1 meg would also work. A smaller value might also work, but at some point might make for less signal to the amplifier.

In this circuit, the volume control is capacitor coupled to the IC. It seemed to work as well when the tap went directly to pin 2 of the IC, but there may be some loading of the IC with a low resistance across it.

In a transistor circuit, trying to use a volume control the same way as in a tube grid circuit would upset the bias of the transistor and mess up the circuit, so the control is normally isolated from the input.

With ICs you often have the option of using a tube type volume control circuit, but the isolated volume control as shown is more common.

The IC is quite sensitive. It is rated at 0.5 V ac maximum input. It only took a tiny amount of the available input voltage for full undistorted output. Going beyond this will certainly cause extreme distortion and may damage the IC.

For your own test purposes, the output from an FM tuner makes a good wide range test signal. An audio oscillator is a good steady test signal. Remember to keep the level low. Start with the IC's volume control all the way down and raise it gently until you get a clear signal.

There is one trick type of control circuit peculiar to the IC which relies on its differential amplifier capability. This is the "common mode" control shown in Fig. 5.[3]

Here the two inputs are played off against each other and the circuit provides very little loading to the IC or the signal source.

This circuit is not common for communications use and is shown for example only. The normal audio hookup of the IC is what you want for most audio or communications purposes.

This basic complete circuit is shown in Fig. 6[2] with typical parts values. This will certainly handle any job you will be interested in doing at first.

Fig. 7[4] shows a similar circuit from an actual receiver schematic. This is only shown for example and not for duplication. One of the interesting things about it is that it would appear to be in error.

Before getting into the errors, look at the input circuit. It is quite similar to the test circuit shown. The inverting input is directly grounded. The 0.001 uF capacitor would appear to be for audio tone quality.

The volume control is similar to the test circuit. The exact significance of the 0.047 uF cap and 10k resistor combination was not explained in the text.

It may be partly for tone quality or perhaps some form of peak limiting to the IC. It may even perform some filtering action in the circuit.

The value of the output resistor is not given nor is the 0.01 uF capacitor explained. Perhaps again for audio response. In any case, that far the circuit is fairly straightforward.

The trouble comes with the rest of the schematic. Part of it suffers from assuming that the reader already knows the LM380 audio IC.

The pin with the asterisk (*) obviously refers to the ground pins 7, 3, 4, 5, 10, 11, and 12. The bypass capacitor obviously refers to the bypass pin. But this is only obvious if you are already familiar with the IC and know that pin 1 is bypassed.

The schematic is ambiguous. The nine could refer to either of the two pins near it. As it happens, pin

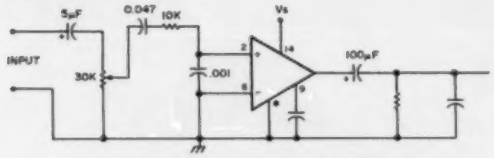


Fig. 7. Schematic from published article.

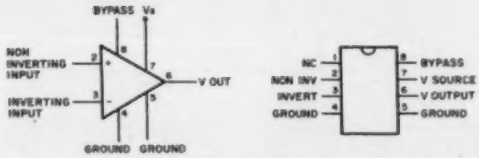


Fig. 8. Mini-DIP 600 mW LM380N-8 symbol and pinout.

nine of the LM380N is no contact, which is quite non-committal.

The bypass should have been labeled pin one and the output is pin eight. All told, this could have been a very frustrating project to duplicate.

This shows why it is so important to get the data sheet for an unfamiliar IC. The pinout diagram would have shown the error and the application notes would have given enough information to make corrections.

Most of the simple audio uses will follow a hookup very similar to our test circuit, which could probably be dropped right into any project using the LM380N as its audio amplifier stage.

The only time you might want to deviate from something similar is when the text clearly gives a reason for a different hookup. A given circuit might be more susceptible to rf pickup or the like and require extra circuitry.

We next come to the LM380CN, the mini-DIP LM380N. This is nothing more than an eight pin IC about half the length of the other. It will still fit into a standard IC socket.

The important thing to watch is that the pin connections are not the same as the other IC, and, of course, the power is not the same.

Other than that, the hookup is just about the same, at least as far as the external components. Fig. 8[1] shows the pinout and schematic symbol and Fig. 9 shows the whole amplifier schematic. It is virtually the same as the other.

Within the 12 volt design range it gives just about the same performance, perhaps slightly less output but not enough to matter.

There is one serious drawback though. To get the comparable output it means that the IC is working at almost full capacity. It runs slightly warm to the touch.

As a design decision, there would seem to be little in favor of using this IC. Unless you are really into teensy, it would be better to use the larger IC.

It will give better performance within that range and it will be running very conservatively. This translates into longer term reliability.

There is a wide price differential between sources for prime quality LM380s, but the usual difference between the 2 Watt and the 0.6 Watt is only about 35¢, hardly worth bothering about.

There are several ways to buy the LM380. You can buy prime quality or an experimenter's selection. This will give you a higher IC count but will contain defective units.

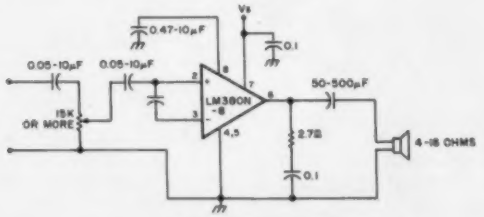


Fig. 9. LM380N-8 600 mW audio amplifier circuit.

For your first time out, get some prime quality. Two or three will do for a start. Then make up a test circuit using your supply and speaker. See how the prime quality units sound and perform. Then you can try the experimenter's bagful.

The selection I got contained several that were not even audio amplifiers, and there were only about 12 usable out of the original 50.

This was quite a bit less than advertised, but on a price per unit basis, quite a bit cheaper than buying prime quality. You will probably get about the same results, but without a working standard to compare with, you may have a hard time testing and knowing that you are right.

This brings up a word about how these things can act up. There are four basic categories of trouble and there may also be some slight shading in between.

1. The unit can be quietly uncommunicative. It just sits there in the circuit and no audio comes out. All other indications are normal.

2. There can be audio but it will be weak or distorted. This is where a knowledge of how the circuit is supposed to work pays off. It could be circuit trouble, too. At this point, you have to wiggle a few wires and make sure the IC is properly seated in the matrix or socket. All other indications are normal.

3. The IC draws too much current. This may or may not give good audio response – usually not or it hums. The IC should not draw more than about 25 mA when idling. Usually it does not go high with the 12 volt or so supply in use. Some ICs want to go a few hundred mA. This is decidedly unhealthy. Scrap them pronto.

4. The IC is suicidal. This IC usually doesn't work at all but draws over an Amp. While testing one, the power supply meter was doing a tarantella at 1.5 to 2 Amps. Not a sound out of the IC. As I reached for the supply lead, smoke began to curl up from the board. Exit one IC.

This brings up a practical testing matter. You don't want to watch your supply go up in smoke because of a defective IC. Make sure your supply is protected by fuses and common sense.

It would be a good idea if the whole physical layout is right within eyesight in front of you when the power is applied. Then if anything takes off you will be able to quickly cut off the power.

I use a clip lead on the ground lead of the power supply and touch it to the circuit ground to apply power at first. If nothing goes wild I clip it on and watch for any later effect. So far my supply has remained in one piece using this system.

This is probably more detail then actually needed for most applications. It really is a simple IC to use successfully. However, by now you should have all the information you need to apply it to any use you have and know how to make allowances in other circuits if you did not have the exact parts specified. ■

References

[1] *Linear Integrated Circuits*, National, Feb., 1973, pp. 5-41.

[2,3] *Linear Applications*, Volume 1, National (Radio Shack) Section AN69.

[4] "Yes, You Can Build This 2m Receiver," Jim Huffman WA7SCB, *73 Magazine*, April, 1976, p. 18.

AMSAT

Amateur radio is about to undergo a fundamental change. About fifty years ago the discovery that the HF bands would support long distance communications revolutionized amateur radio. At that time amateurs were limited to working their friends across town or the occasional DX station using high power and long wire antennas on the long wave bands. With the introduction of the short wave bands, DX contacts became commonplace, with small antennas and relatively low power. Encouraged by this DX potential, amateurs explored the HF bands, using shorter and shorter waves to work the world. Time passed, technology improved, frequencies got higher, and wavelengths shorter, until a barrier was found at a wavelength of about ten meters. The ionosphere only allowed reasonably reliable DX contacts at frequencies below about 30 MHz. Thus, for years, DX contacts were in the main limited to HF. Now that barrier is being broken and a fundamental change in amateur radio is again about to take place.

In the change that amateur radio is about to undergo, whole new bands will open up, with characteristics unlike any of those existing at present. When will that change take place? It will begin with the successful launch of the first AMSAT-Phase III spacecraft now scheduled for late in 1979.

AMSAT is a worldwide organization of radio amateurs with more than 3000 members in over 85 countries. However, everyone communicating via the AMSAT-OSCAR 6 and 7 spacecraft are not members of AMSAT, and there is no requirement that they become members. It is estimated that many thousands of radio amateurs have made use of the OSCAR spacecraft. If you count the amateurs who have been involved in commanding the spacecraft (so as to ensure that they are available for use when scheduled), and you count those amateurs involved in publicizing AMSAT (and making known the capabilities of the existing satellites and the potentials of the new ones), and you count the amateurs building those new ones, you will find that only a few hundred out of an estimated 50,000 radio amateurs worldwide are pioneering their way into the satellite era of amateur radio.

AMSAT is currently managing the day-to-day operations of the AMSAT-OSCAR 6 and 7 spacecraft. These satellites are in low altitude orbits and allow communications ranges of up to 5000 km or so without any skip zones. However, the band is open for only about 20 minutes at a time, five or six times a day, when the satellite passes within range. While satellite communications are indeed possible, they are somewhat more difficult than conventional communications using the HF bands. Also, relatively little commercial equipment is available to users at this time. The AMSAT-Phase III spacecraft will open the VHF bands for hours at a time. In use, these bands will appear to be similar to the HF bands, in that they will open up for communications with stations to the east of the user, slowly change to include areas to the north and south, and then open up to the west before closing down. There will, however, be a lot of overlap between these areas. Contacts will be possible with the whole of the northern hemisphere and much of the southern for hours at a time with no skip zones. No skip zones. Can you imagine what that will mean? Anyone in the northern hemisphere will be able to hear anyone else. Can you imagine a round table QSO between stations in New York, Washington, Los Angeles, Miami, Tokyo, Paris, Tel Aviv and Moscow – all able to hear each other at the same time? This is not possible using the HF bands. Nets, emergency traffic handling, educational demonstrations and plain CQ calls will all assume a new dimension.

Japanese amateurs working on prototype of Mode J transponder for the AMSAT-OSCAR D spacecraft.

Tom Clark WA3LND standing next to a low cost portable OSCAR terminal on the mall in Washington DC at the opening of the National Aeronautics and Space Museum, July, 1976.

Historically, AMSAT has worked to build operational, simple to use satellites, and now our goal is within sight. Our space program has been international in the true cooperative spirit of amateur radio. Our first spacecraft was AUSTRALIS-OSCAR 5, built in Australia by radio hams at Melbourne University. It was not a communications satellite, but carried, among other things, a prototype command system which proved that radio amateurs could control the operation of satellites in outer space. AMSAT-OSCAR 6, built by Australian, German, and American hams, was the first long-life amateur radio communications satellite. Designed for a one year lifetime, it is only now showing signs of old age after four and a half years of faithful service. AMSAT-OSCAR 7, built by American, Australian, Canadian, and German hams, is now approaching its three year operational design lifetime.

In order to keep interest in space communications active through 1980 (when the first AMSAT-Phase III spacecraft is expected to become operational), AMSAT is stretching its

Dave Clingerman W6OAL, conducting a classroom demonstration.

resources and building one more low orbit satellite (known as AMSAT-OSCAR D until launch). AMSAT-OSCAR D (or A-O-D) is a joint effort of the Japanese AMSAT Association, Project OSCAR, and the ARRL, all working closely in cooperation with AMSAT. AMSAT-OSCAR D is presently scheduled for launch in late 1977, and is primarily intended for continuing support of the educational program. Once the spacecraft is launched and in orbit, it will become AMSAT-OSCAR 8 and will be considered to be in the public domain, so that anyone can use it for communications purposes. The ARRL will then become responsible for all the operations management aspects of the satellite. To ensure operation consistent with the design of the spacecraft, AMSAT will act as technical consultants for the operations management of AMSAT-OSCAR 8 during its active lifetime. The ARRL will also pay AMSAT the sum of $50,000 to partially reimburse AMSAT for the development and construction costs of the spacecraft. Space satellites are not cheap. AMSAT-OSCAR 7 cost in the neighborhood of $60,000, but a similar commercial communications spacecraft could have cost $2,000,000.

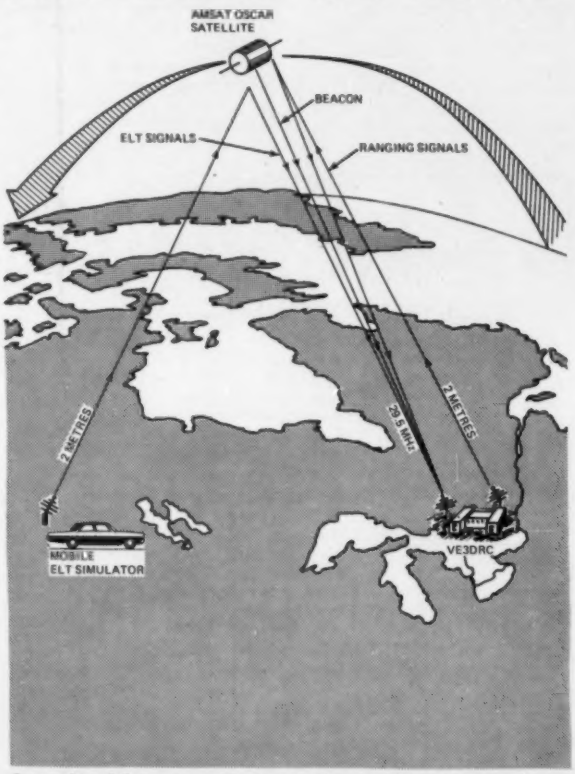
AMSAT also has a policy of not obsoleting equipment. AMSAT-OSCAR 6 carried a 145.9/29.5 MHz transponder. AMSAT-OSCAR 7 introduced a UHF/VHF transponder on 432/145.9 MHz. This transponder, designated as MODE "B" (145.9/29.5 became MODE A), clearly demonstrates the superior capabilities of VHF for amateur satellite transponders. The mode B link on AMSAT-OSCAR 7 is clearly superior to the mode A links of AMSAT-OSCARs 6 and 7. AMSAT-OSCAR D will also carry a mode A transponder and a new mode J transponder (built in Japan) on 145.9/435.15 MHz. Similarly, the first of the AMSAT-Phase III spacecraft will carry two transponders, utilizing modes A and J. Thus, as amateurs become more interested in satellite communications and obtain equipment, they can be sure that their investment will not become obsolete with the passing of any one spacecraft.

The AMSAT-Phase III spacecraft will be accessible with full quieting SSB or CW signals by any amateur radio station using an output power of the order of 50 Watts, and small, rooftop, TV-style antennas. Thus, any apartment dweller with a balcony having some northern exposure will be able to work the world. In fact, the performance of this equipment communicating through an AMSAT-Phase III spacecraft will usually be superior to a kW-quad combination on the HF bands.

Amateur spacecraft have long passed the days when launches were made available because the spacecraft were there, or to demonstrate that hams could do it too. There are now many spacecraft competing for launch opportunities. AMSAT thus has to show how the piggyback launch can be implemented for a minimum of cost to the launching agency, and also show cause as to why a spacecraft should even be carried aloft in the first place. Thus the OSCAR series spacecraft have also been used for scientific and public service demonstrations of communications capabilities. There have been educational transmissions to introduce the space sciences to students in classrooms, and demonstrations of an emergency crashed aircraft locating technique in Canada and the USA, which has shown that it is possible to pinpoint the position of a simulated crash site to within a few miles of the exact location. NASA is now studying an operational satellite system to do just that, saving incalculable numbers of lives and thousands of dollars in search and rescue costs. Data collection techniques using remote sensors relaying data via satellite to a central location have been demonstrated. Mobile terminals have been set up in cars, boats and private aircraft. Medical emergency traffic has been simulated. Electrocardiograph data has been transmitted coast to coast, phone patches have linked Hawaii to the mainland US, and direct "broadcasting" experiments have taken place. Many of these activities are only being talked about by the professionals, or, if they are being done, are being done at many times the cost, in terms of both the spacecraft and ground equipment.

AMSAT-OSCARs 6 and 7 have paved the way. They have shown that we can use the satellite bands and have some grasp of the potential that they have to offer, but impressive as these are, much is yet to come. Contacts via AMSAT-OSCARs 6 and 7 require some technical expertise. The spacecraft must be tracked as they speed across the sky, since passes only last about 20 minutes and the range is limited. The AMSAT-Phase III spacecraft will change all that. Spacecraft QSOs will become very simple to implement. Communications will be possible for hours at a time, but these capabilities will not come for free.

Hardware costs for the first



Conception of the emergency locator experiment used for locating crash sites. The computer interface was located at VE3DRC. Tests showed that the crash could be pinpointed to within a few miles of the actual site.

AMSAT-Phase III spacecraft are estimated at $200,000 (a government or commercial spacecraft providing similar performance would cost millions).

How can you help? First of all you can become a member of AMSAT. Dues are only $10 per year. If you are already a member (and even if you are not), you can become a life member for a donation of at least $100. You will then receive the *AMSAT Newsletter*, a quarterly publication devoted to amateur satellite communications. It contains details about existing, future and planned spacecraft. It contains operating news and acts as a forum for communicators. You can also encourage your local radio club to become a member society at $20 per year ($200 life).

You can also help the AMSAT-Phase III program financially by sponsoring part of the satellite. You can sponsor any number of solar cells ($10 each), battery cells ($200 each), solar panels ($2,000 each), transponders ($5,000 each), an onboard microcomputer ($8,000), or a rocket motor ($10,000). All donations including the $100 life membership donations are tax deductible under section 170 of the IRS Code. All sponsors will receive a certificate suitable for framing acknowledging their contribution. A plaque honoring for posterity contributors of $1,000 or more will be carried on the spacecraft in orbit around the Earth, and contributors will receive a replica of the plaque as a momento.

If you are willing to contribute time or money and would like to get involved in bringing a new era to amateur radio, join AMSAT's team. For further information about all aspects of AMSAT and the ongoing amateur radio satellite communications program, write to me, Joe Kasser G3ZCZ/W3, c/o AMSAT, Box 27, Washington DC 20044.

CHICAGO FM CLUB HOSTS OSCAR NET

The Chicago FM Club has begun holding a weekly OSCAR net on its two meter 16/76 repeater. The net, hosted by Ralph Wallio K9JPR, disseminates late information gathered from low band OSCAR nets meeting earlier in the evening, and rebroadcasts them at 9:00 pm Chicago time on Tuesdays. Ralph also gives the OSCAR 6 and 7 orbit times for the Chicago area for the coming week, and answers questions concerning the satellites' operations.

CONTESTS

Editor:
Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

IARS/CHC/FHC/HTH QSO PARTY
Starts: 2300 GMT Friday, June 3
Ends: 0000 GMT Monday, June 6

An SASE to K6BX will bring detailed information. Contest is open to all amateurs and SWLs worldwide. Same station may be worked on each band and mode; SSB and AM are different modes.

EXCHANGE:

QSO number, RS(T), name, CHC/FHC number, US state and county or similar division. Non-members send HTH instead of CHC/FHC number.

SCORING:

CHCers – score 1 point per QSO with other CHCers, 2 points per QSO with HTHers; 1 additional point if YL, B/P, FHC, Novice, CHC-200, Merit or Club station, or if on VHF/UHF; double above points if QSO is outside own country. HTHers – contacts with other HTHers count 1 point, with CHCers count 3 points. Rest same as above. SWLs – use above depending on whether CHC member or not.

MULTIPLIERS:

Each different continent, country, ITU zone, and US state counted only once.

FINAL SCORE:

Multiplier times total QSO points is final score. Multi-operator stations divide score by number of operators.

FREQUENCIES (for US and DX as allowed):

CW – 3575, 3710, 7070, 7125, 14075, 21075, 21090, 21140, 28090, 28125. Phone – 3770, 3775, 3790, 3943, 3960, 7070, 7090, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620.

AWARDS:

Hundreds of certificates and trophies in all categories and divisions are awarded. An SASE will bring further information from K6BX. Send all requests and logs to: International Amateur Radio Society, K6BX, PO Box 385, Bonita CA 92002. Logs should be mailed within 15 days after the close of the QSO Party.

MINNESOTA QSO PARTY
Starts: 1800 June 4
Ends: 2359 GMT June 5

Sponsored by the Heartland Amateur Radio Club, Staples High School. No restrictions as to mode or operating time, all bands 80-10 mtrs. Only one transmitter allowed in operation at one time; no crossband contacts. Novices compete against Novices, Techs against Techs. Net QSOs are not valid. Please do not interfere with nets or traffic sessions.

EXCHANGE:

RS(T), county (MN only), ARRL section or country (others).

FREQUENCIES (+/- 5 kHz):

Phone: 3910, 7235, 14280, 21365, 28525. CW: 3525, 7035, 14035, 21035, 28035. Novice/Tech: 3725, 7125, 21125, 28125.

SCORING:

One point per QSO, 2 points if on CW, 5 points if Novice or Tech. (Note: Novices and Techs must identify their license class each QSO, such as WBØXXX/N, or /T.) WBØTTZ, the HARC station, counts 10 points per QSO per band. MN stations multiply number of ARRL sections plus DX countries (W/VE excluded) times QSO points. Others multiply QSO points by number of MN counties (max. 87). Phone and CW are one contest – please score as such.

ENTRIES/AWARDS:

Details and log sheets available after May 10 upon receipt of an SASE. Stations making 50 or more QSOs must include a check sheet for each band and mode used. Logs must include date/time in GMT, band, mode, and exchanges. Certificates to state winners as well as high Novice and Tech scorers in USA and DX stations. MN stations must have 10 QSOs from a county for county awards. SASE required for return of awards and summary. Usual disqualification criteria. Logs must be postmarked by July 2nd. Send logs to: HARC, c/o Steven J. Gardner WBØMAO, PO Box 261, Staples MN 56479.

SOWP QSO PARTY
Starts: 0000 GMT June 4
Ends: 2400 GMT June 5

The Society of Wireless Pioneers, SOWP, will hold their 2nd annual CW QSO Party with a certificate issued to all participating members who contact 10 or more fellow members during the event.

FREQUENCIES:

55 kHz up from low end of each band. Novices should try the middle of each band.

EXCHANGES:

SOWP identification numbers as minimum, other optional.

ENTRIES/CERTIFICATES:

Members desiring a certificate are required to submit a listing of contacts made with call, member's number, and time of contact. All entries should be mailed to: Pete Fernandez W4SM, VP for Awards, 129 Hialeah Road, Greenville SC 29607. Include an SASE and mail no later than June 20th.

ARRL VHF QSO PARTY
Starts: 1900 GMT Saturday, June 11
Ends: 0600 GMT Monday, June 13

Check the May issue of QST *for any last minute changes!*

Entrants may operate no more than 28 of the 35 hours during the contest period. The seven hours off-time must be taken in increments of 30 minutes or more. Listening time counts as operating time. All contacts must be made on amateur bands above 50 MHz using authorized modes. Fixed, portable, or mobile operation under one call, from one location only, is permitted. Any transmitter used to contact a station may not be later

CALENDAR

June 3-6	IARS/CHC/FHC/HTH QSO Party
June 4-5	Minnesota State QSO Party
June 4-5	SOWP QSO Party
June 11-13	ARRL VHF QSO Party
June 18-20	West Virginia QSO Party
June 25-26	ARRL Field Day
July 2-3	QRP – Summer – Contest
July 4	ARRL Straight Key Night
July 9-10	IARU Radiosport Championship
July 16-17	Apollo II 8th Anniversary Contest
July 16-17	10-10 Net Summer QSO Party
Aug 20-21	New Jersey QSO Party
Aug 20-21	Worldwide SARTG RTTY Contest
Sept 10-11	Washington State QSO Party
Sept 10-11	ARRL VHF QSO Party
Sept 24-25	Delta QSO Party
Oct 1	Open CD Party – CW
Oct 15-16	Open CD Party – Phone
Oct 15-17	Manitoba QSO Party
Nov 5-6	ARRL Sweepstakes – CW
Nov 12-13	IPA Contest
Nov 13	OK DX Contest
Nov 19-20	ARRL Sweepstakes – Phone
Nov 19-20	WWDXA Internation CW Contest!!
Dec 3-4	ARRL 160 Meter Contest
Dec 10-11	ARRL 10 Meter Contest

used to contact another station during the contest period with any other callsign. Contacts made by retransmitting either or both stations (such as repeaters) do not count for contest purposes. Each contact exchange must be acknowledged by both operators before either may claim contact points. A one-way confirmed contact does not count.

EXCHANGE:

Exchange simply ARRL section.

SCORING:

On 50 or 144 MHz count 1 point per contact; on 220 or 420 MHz count 2 points per contact; on higher UHF bands count 3 points per contact. Final score is then the total QSO points multiplied by the number of different bands for additional credits, but crossband contacts are not allowed. Also, aircraft mobile stations cannot be counted for section multipliers.

ENTRIES:

All logs must be postmarked no later than July 7th and sent to: ARRL, 225 Main Street, Newington CT 06111. Logs and entry forms are available through this same address; please include an SASE. Usual awards will be issued and the standard disqualification rules will apply.

WEST VIRGINIA QSO PARTY
Starts: 2300 GMT Saturday, June 18
Ends 2300 GMT Monday, June 20

All amateurs are invited to participate in the QSO Party sponsored by the West Virginia State Amateur Radio Council. There are no operating time limits during the contest period. The same station may be worked on different bands for additional points, but only once per band regardless of mode. West Virginia stations may work each other.

FREQUENCIES:

35 kHz up from the bottom edge of each CW band and 10 kHz inside the general portion of each phone band.

EXCHANGE:

QSO number; RS(T); and county (if WVA), state or country.

SCORING:

A power multiplier will be allowed as follows: 200 Watts or less dc input = 1.5; over 200 Watts dc input = 1.0. Out-of-state stations determine their score by multiplying the number of QSOs times the number of different West Virginia counties worked (55 max.). This total is then multiplied by the power multiplier as defined above for the total score. West Virginia stations multiply the total number of QSOs by the sum of the different WVA counties, US states, and ARRL countries worked. This result is then multiplied by the power multiplier to determine the final score.

AWARDS:

To be eligible for an award, a station may have only one unassisted operator. Awards will be issued to the highest scoring WVA station, 1st runner up in WVA, 2nd runner up in state and the highest scoring station in each state and country. Decisions of the Contest Committee of the West Virginia State Amateur Radio Council will be final.

LOGS/ENTRIES:

Logs must indicate date, time, QSO number, callsign, QSO number received, signal reports, and county, state or country of the station worked. Indicate the mode and band also. Logs should be sent to: West Virginia QSO Party, PO Box 299, Dunbar, West Virginia 25064. Logs should be received no later than July 16th, and no logs will be returned.

ARRL FIELD DAY
Starts: 1800 GMT Saturday, June 25
Ends: 2100 GMT Sunday, June 26

Rules are generally lengthy (2 pages in *QST*); please refer to the May issue of *QST* for detailed information and for any changes since last year's rules. Briefly, the general rules are as follows:

The contest is open to all amateurs within the ARRL sections; foreign stations may be contacted for credit but are not eligible to compete. Each entry will be classified by type of operation: Class A – club group set up specifically for Field Day operation operating portable without commercial power; Class B – non-club stations set up portable without commercial power; Class C – mobile stations; Class D – fixed stations using commercial power; Class E – fixed stations using emergency power for transmitters and receivers.

All entries will further be classified by the number of transmitters utilized. Class A and B stations not beginning to set up before 1800 GMT on Saturday may operate the entire contest period. All others may not operate more than 24 hours total. Each station may be worked once on each band; voice and CW are considered different bands (all voice contacts are equivalent and RTTY = CW).

Class A, B, and C stations may contact anyone, but classes D and E must contact only Class A, B, or C.

EXCHANGE:

RS(T) and ARRL section or country.

SCORING:

Phone contacts count 1 point each and CW contacts count 2 points each. Final score is sum of QSO points times multiplier for highest power used at any time during the contest period, plus bonus points. Power multipliers: Multiply by 5 if 10 Watts or less dc input power and non-commercial main power source or motor driven generator; multiply by 2 if less than 200 Watts; multiply by 1 if over 200 Watts up to 1 kW; multiply by 0 if over 1 kW (note – dc power on SSB is half PEP power). Bonuses: (only for Class A or B stations) 100 points for 100% emergency power; 100 points for "natural" powered contact (only one QSO req'd); 50 points for public relations; 50 points for message origination for SCM or SEC; 5 points for each message received and relayed during FD period up to a maximum of 50 points; 50 points for completing at least one QSO on CW via OSCAR.

ENTRIES:

Standard disqualification rules apply. All entries should be sent to: ARRL, 225 Main Street, Newington CT 06111. Official log and entry forms are available from the same address for an SASE.

SARTG ACTIVITY TEST
1815 to 1930 GMT, last Wednesday of each month during 1977

FREQUENCY:

3.6 MHz (RTTY).

EXCHANGE:

RST and QSO number from 001 each month.

POINTS:

Bulletin station counts 2 pts., all other contacts with Scandinavian stations count 2 points.

ENTRIES/AWARDS:

Logs should be sent not later than 8 days after test to: Einar M. Thomassen LA1LN, Radyrvegen 30, N 3900 Porsgrunn, Norway. Results will be published in the monthly *SARTG Bulletin* and the year's result will be calculated according to the best 9 of 12 possible rounds. Diplomas will be given to the 5 best stations! Note: The bulletin station is currently LA3S, but may be changing callsign!

WORKED SCANDINAVIAN AMATEUR TELETYPERS

Offered by the SARTG for 2 Watt RTTY contacts with the following number of Scandinavian stations: Scandinavian stations – 25 (general), 50 (bronze ribbon), 75 (silver ribbon), 100 (gold ribbon); European stations – 16 (g.), 35 (b.r.), 50 (s.r.), 75 (g.r.); other countries – 8 (g.), 15 (b.r.), 25 (s.r.), 50 (g.r.).

All bands may be used. QSL cards for general class and bronze and silver ribbons are not necessary – just list calls, dates, and times of contacts. For gold ribbon it is essential to have contacts with the following prefixes: LA, SM, OH, TF, OX, OY, OZ. Reference to SARTG contest logs or photocopies of 7 QSL cards is sufficient. Fees are 10 IRCs for general class and 6 for ribbons. Applications should be addressed to: Carl Jensen OZ2CJ, Meisnersgade 5, Randers, Denmark.

VERMONT CENTURY CLUB AWARD

In celebration of VT's bicentennial, the Burlington ARC has reinstated the VT Century Club Award that was first issued in 1966. The award is available to any amateur for confirmed 2-way contacts with VT stations. Contacts may be on any HF band on any mode. The award will be issued for an indefinite period, with all contacts made during 1977 and later applying for the award. The basic award certificate will be issued for working 10 different VT stations. Seals for working 25, 50, 75, and 100 additional stations (10 initial contacts count as part of first 25 total). Applicants should submit list of calls in alphabetical order, showing city, date, band, and mode for each worked. Those sending in lists for higher class endorsements should indicate which seal is desired. QSLs must be in your possession, but should not be submitted. Instead, a written certification of the above list by another amateur will be accepted as satisfactory proof. The award chairman reserves the right to inspect any or all of the QSLs. The fee is $2.00 for US stations or equivalent for DX. Make check or money order payable to the Burlington Amateur Radio Club, Inc. No fees for higher class seals, but an SASE must be included. Send all applications or inquiries to: The Burlington ARC, VTCC Award Manager, PO Box 312, Burlington VT 05402.

The Vermont Century Club

AWARD CERTIFICATE

FOR AMATEUR RADIO COMMUNICATION WITH

The Green Mountain State

This is to certify that ..... operator of Amateur Radio Station ..... has submitted satisfactory evidence of two-way communication with at least ..... Amateur Radio Stations located in the state of Vermont, and is hereby conferred membership in the Vermont Century Club, in the class designated in the award and its subsequent endorsement. Band ... Mode ... may be offered herein.

SAMPLE SAMPLE SAMPLE SAMPLE SAMPLE

In witness whereof, the trustees of the BURLINGTON AMATEUR RADIO CLUB, INC., have this day affixed their official signatures.

Award No. ..... Award Chairman

Dated .....

Rod Hallen WA7NEV
P.O. Box 73
Tombstone AZ 85638

Uncle Sam's Surplus List

- - and how to get on it

Each month, the United States Government auctions off tons of surplus supplies and equipment through its Defense Property Disposal Service. DPDS is Uncle Sam's abbreviation. Examples of the types of materials involved include: scrap metals, fire control equipment, aircraft and aircraft components, naval ships, railway equipment, motor vehicles and components, wood and metal working equipment, refrigeration and air conditioning equipment, heating and plumbing equipment, tools, electrical and electronic equipment (1. communications, 2. electrical parts, 3. computers and peripherals, 4. lighting and alarm systems), medical and laboratory equipment, photographic equipment, home and office furniture and supplies, appliances, AND SO MUCH MORE!!

Much of the merchandise offered for bid is declared surplus because of a lack of need for it on the government's part rather than because it is worn out. Most of it is in fair or better condition and has usually been well maintained. These auctions are open to all and most of them are conducted by mail. Bids are usually a penny or two on a dollar's original value. Auctions are held for every United States Military Installation in the world, so there is sure to be one or more near you.

Getting on the Bidders Mailing List

In order to be placed on the Official Bidders Mailing List, it is necessary to apply to the Defense Property Disposal Service. The DPDS address and a suggested form will be found at the end of this article. Upon receipt of your request, the DPDS will send out an official application blank plus booklets explaining how to buy, what classes of materials are generally available, and what the rules are. You choose the type(s) of equipment you are interested in and the locations you are willing to pick up from if your bids are successful. The merchandise is broken down into classes and the areas are usually states.

When this application blank is returned to DPDS, your name will be placed on the Official Bidders Mailing List, and each time that some material that you want is available at locations that you have chosen, you will receive a bid catalog. Depending on the number of classes that you are listed for, it is possible to get quite a few catalogs each month.

Here's how it works: Say you are interested in aircraft components and electrical and electronic equipment in California. Each time that a catalog is issued that includes either of these two categories and some of which is in California, you will receive a copy. It may also include material you are not looking for or locations outside of California, but that is OK. You bid on what you want, when it is located where you want it!

Let's Look at the Catalog

These usually cover a broad category: aircraft or automotive or electronics, for example, and a group of contiguous states. All material is always available for inspection before bidding; therefore, the first item in the catalog is a list of the military installations involved and the names and telephone numbers of persons to contact for information and inspection. It is not necessary that you inspect before bidding, but it is recommended, especially on large bids.

Next, the equipment to be auctioned off is listed and described. Its specific location on the military installation is given and how it is packaged. Its condition is stated as poor, fair, good, or excellent, and whether it is used or unused. Its total weight and original cost are given. Some items are sold by lot, some by weight, and some per each. You bid accordingly.

After all of the merchandise to be auctioned has been listed, general bidding information is covered, as well as information on loading. Generally the government will load heavy bulky items, but not always.

Some bids require a 20% deposit, and when this is the case, it will be clearly stated. Of course, if yours is not the high bid, your deposit will be returned. It is entirely possible that only part of your bid will be successful if you bid on more than one item.

Each catalog has a bid opening date and time and all bids must be received before that date and time to be considered. If you are notified that your bid has been accepted, you will be expected to pay the remainder owed and remove your merchandise within a period of time stated in the catalog.

Remaining on the Bidders List

It is necessary to bid at least once every five catalogs in a given class to remain automatically on the Official Bidders Mailing List. However, you can continue your

name on the list by simply requesting that it remain there. Here's how that works: The DPDS will indicate on a catalog mailing label that they are about to drop your name from the bidders list for lack of activity. Included in each catalog is a renewal form that you fill in and mail back to DPDS. You're now good for another five months. You can continue this way indefinitely, but bidding is more fun. It's easier than it sounds.

Items purchased can be for your own personal use or for resale. For instance: 200 VHF radios bought at $2 each and sold at $20 each would make a nice profit. Most items are sold in quantity and the price per each is low, regardless of the original cost or present value. This could make for a pleasant and beneficial part time business.

That's it! It's easy! It could be profitable! Good luck! ■

Request for Department of Defense Surplus Bidders Application

Fill out the form below or a copy of the same information and send to:

DOD Surplus Sales
P.O. Box 1370
Battle Creek MI 49016

Request for Department of Defense Surplus property Bidders application.

NAME

STREET ADDRESS OR PO BOX

CITY STATE ZIP CODE

KENWOOD's new TR-7400A 2 meter transceiver has got it all together

Send for complete details. Priced at only $395.00

Master Charge BankAmericard

FRECK radio & supply co., inc.

252 Patton Ave., Asheville, N.C. 28801

PHONE: (704) 254-9551 F3

The SPEEDY-SPINNER KNOB gives you what the Engineer forgot! No more tedious dial twisting. QSY rapidly from one end of the band to the other. $1.95 plus 25¢ mailing charge.

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Saddle River NJ 07458

B15

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1-1 impedance match
For dipoles, beams, inverted "V", and quads

* Center insulator with BALUN $13.50
* Center insulator without BALUN $8.50
* Dragon Fly antenna construction sheet and drawing $2.00

postpaid USA

Patent No. D219106

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Q1 Ferrite

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K6

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(408) 988-1640

Q3

Quest ELECTRONICS

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

Not a Cheap Clock Kit $17.45
Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instructions. **Same clock kit with .80" displays. $22.75**

Digital Temperature Meter Kit
Indoor and outdoor. Automatically switches back and forth. Beautiful .50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure −100° to +200°F, air or liquid. Very accurate. Complete instructions. **$39.95**

8080A Microcomputer Kit
8080A CPU, Crystal Clock, I/O Buffers, RAM and PROM. D/A—A/D converter. PROM Programmer. Memory expandable. Complete documentation incl. assembly instruct., programming etc. **$195.00**

1977 IC Update Master Manual Brand new. Complete integrated circuit data selector from all manufacturers. 1264 page master ref. guide to the latest IC's including microprocessors and consumer circuits. 17,000 cross references for easier sourcing of hard to get parts. **$30.00** with free update service thru 1977. Domestic postage add $2.00. Foreign $6.00.

Frequency Counter Kit
Covers audio, ultrasonic and low amateur band 10 Hz to 2.5 MHz typ. Dual channel high sensitivity ±25 millivolts. Crystal controlled clock. Can be prescaled for higher frequency. 6-.50" digits. Full instructions. Less power supply. **$40.00**

30 MHz Frequency Counter Kit
Crystal time base. Covers audio, amateur and CB band. 6.5" digits, prescalable with PC board and full instructions. **$55.00**
Fully wired and tested. **$75.00**
Add $10.00 for beautiful plexiglass case.

Stopwatch Kit $26.95
Full six digit battery operated. 2–5 volts. 3.2768 MHz crystal accuracy. Times to 59 minutes, 59 seconds, 99 1/100 hrs. Times standard, slit and taylor. 7205 chip, all components minus case. Full instruct.

COSMAC 'ELF'
RCA CMOS Microcomputer
CDP1802 CD **$29.50** Users Manual **$7.50**
Complete kit of parts to build the "ELF" including CDP1802 and users manual as listed in August '76 Pop. Elect. minus power supply and board. **$92.00**

60 Hz Crystal Time Base Kit $4.75 Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy. Kit includes: PC board, MM5369, crystal, resistors, capacitors and trimmer.

VOLUME SPECIALS

		1	100
MM5262	2K RAM	3.00	2.50
MM5369	Divider	2.10	1.40
2102-1	500 NS 1K RAM	1.80	1.30
PD411-3	150 NS 4K RAM	9.00	5.75
Momentary Pushbutton Switch		.50	.29

Other parts also available

Portable Clock Timer Kit $19.95
.50" clock module, crystal time base. Operates from 9V battery. Complete with case and instructions. Excellent for airplane, darkroom, car, etc.

Stopwatch/Timer Kit $55.00
4 Digit, 7 function programmable stopwatch/timer. Two PC boards, components and case. Crystal controlled, this kit is excellent for rally and events as well as navigational, photography and for appliance control.

Auto Clock Kit $15.95
DC clock with 4-.50" displays. Uses National MA1012 module with alarm option. Crystal time base PC boards and full instructions. Add $3.95 for a beautiful dark gray case ready to install. This is the best value available anywhere!

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax. BankAmericard and Master Charge accepted. Shipping charges will be added.

FREE: Send for your copy of our 1977 QUEST CATALOG. Include 13¢ stamp.

NEW

DIGITAL CLOCK with 10 MINUTE TIMER

6 digits – 12/24 hour

Here's the kit everyone has been asking for! Never fail to identify your station again. And it's easy to use, just tap timer button to start, 9 minutes later the display will flash on and off to alert you. Reset it by simply touching the timer button or it will reset itself automatically after two minutes! Other features are: jumbo .4" LED readouts, durable extruded aluminum case available in 5 colors, plug transformer, Polaroid lens filter, time set buttons, finest quality PC boards and super instructions. You get all parts – no extras are needed, unlike some of the kludges our competitors offer! Colors available: gold, black, silver, bronze, blue (specify). Size: 4.25" x 1.5" x 1.5".

Clock Kit with 10 min. timer, DC-10 ..... $25.95
Regular 12/24 hr clock kit 22.95
Alarm clock, 12 hr only, DC-8 ..... 24.95
Kits are also available fully assembled and tested, just add $10 to kit price.

CAR CLOCK 12/24 HR 6 DIGIT $25.95

- High accuracy (1 minute/month)
- Big .4" LED display
- Special circuit suppress all voltage spikes and transients
- Same case as illustrated above
- Display blanks with ignition off
- Reverse polarity protected

Complete Kit, DC-7 ..... $25.95
Assembled and calibrated ... 35.95

CALENDAR ALARM CLOCK 6 Digit LED 12/24 Hour

Has every feature one could ever ask for. Kit includes everything except case, build it into wall, station or even car! **FEATURES:**

- 6 Digits, .5" High LED
- 12/24 Hour Format
- Calendar shows mo./day
- Snooze button
- True 24 Hour Alarm
- 7001 chip does all!!
- Battery back up with built in on chip time base

Complete Kit, less case, DC-9 ..... $34.95

600 MHz PRESCALER $59.95

Assembled and tested. Extend the range of your counter to 600 MHz. Works with all counters. Available in kit form for $44.95. Specify ÷10 or ÷100 with order.

30 WATT 2 Meter Power Amp

The famous RE class C power amp now available mail order! Four Watts in for 30 Watts out, 2 in for 15 out, 1 in for 8 out. Incredible value, complete with all parts, instructions and details on T-R relay. Fully stable, output short proof, infinite VSWR protected! Case not included.

Complete Kit $22.95

COMING SOON: VIDEO TERMINAL KIT

SEND FOR DETAILS
$149.95

TTL		LINEAR		REGULATOR		TRANSISTORS	
74S00	.35	555	.50	309K	.99	NPN 2N3904 type	10/$1.00
74S112	.75	556	.75	309H	.99	PNP 2N3906 type	10/$1.00
7447	.79	567	1.75	340K-12	1.25	NPN Power Tab 40W	3/$1.00
7473	.35	1456	.50	7805	.99	PNP Power Tab 40W	3/$1.00
7475	.50	LED DRIVER		7812	.99	FET MPF-102 type	3/$2.00
7490A	.55	75491	.50	7815	.99	UJT 2N2646 type	3/$2.00
74143	3.50	75492	.50	7818	.99	2N3055 NPN Power	.75

SPECIAL

DIODES: 1KV,2.5A ..... 5/$1.00 100V,1A ..... 10/$1.00 1N914A type ..... 50/$2.00

LED DISPLAYS

FND 359 ..... .4" C.C. ..... .75
FND 510 ..... .5" C.A. 1.25
DL 707 ..... .33" C.A. 1.25
HP 7730 ..... .27" C.A. 1.25
Red Polaroid Filter ... 4.25" X 1.125" ... .59

741 OP-AMP SPECIAL
Factory prime mini dip with both Xerox and 741 part numbers
10 for $2.00

SOCKETS

14 PIN	5/$1.00
16 PIN	5/$1.00
24 PIN	2/$1.00
40 PIN	3/$2.00

FERRITE BEADS
with info and specs
15/$1.00
6 hole Balun Beads
5/$1.00

SOCKET KIT
Assortment of 12 most used IC sockets. Good to have around the shop. $1.95

8080A $16.95
Factory Prime – includes FREE socket!

21L02-1 $1.95 Fast 450 ns Low Power

60 Hz XTAL TIME BASE
- Runs on 5-15 VDC
- Low current (2.5 ma)
- Operate clocks in car, boat, plane
- 1 minute/month accuracy

Kit, TB-7 ... $5.50
Assembled & Calibrated ... $9.95

CHEAP CLOCK KIT $9.95
DC-4 Features:
- 6 digit .4" LED
- 12 or 24 format

Does not include board or transformer

PC Board $2.95
Transformer $1.49

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MINI-KITS

FM Wireless Mike Kit $2.95
FM-1

Transmit up to 300' to any FM broadcast radio. Sensitive mike input requires crystal ceramic or dynamic mike. Runs on 3 to 9 V. Super sensitive model FM-2 .. $4.95

TONE DECODER KIT

A complete tone decoder on a single PC Board. Features: 400-5000 Hz adjustable frequency range, voltage regulation, 567 IC. Useful for touch-tone decoding, tone burst detection, FSK demod, signaling, and many other uses. Use 7 for 12 button touchtone decoding. Runs on 5 to 12 volts.

Complete Kit, TD-1 ..... $4.95

LED BLINKY KIT

A great attention getter which alternately flashes 2 Jumbo LEDs. Use for name badges, buttons, or warning type panel lights. Runs on 3 to 9 volts.

Complete Kit $2.95

SUPER-SNOOP AMPLIFIER

A super-sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as a general purpose test amplifier. Full 2 watts of output, runs on 6 to 12 volts, uses any type of mike. Requires 8-45 ohm speaker.

Complete Kit, BN-9 ..... $4.95

MUSIC LIGHTS KIT

See music come alive! 3 different lights flicker with music or voice. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300 watts. Great for parties, band music, nite clubs and more.

Complete Kit, ML-1 ..... $7.95

SIREN KIT

Produces upward and downward wail characteristic of police siren. 5 Watts audio output, runs on 3-9 volts, uses 8-45 ohm speaker.

Complete Kit, SM-3 ..... $2.95

CODE OSCILLATOR KIT

Powerful 1 watt audio oscillator of approx. 1 kHz, good for many uses. Great for warning alarm, battery checker, voltage indicator and code oscillator.

Complete Kit, CPO-1 ..... $2.50

POWER SUPPLY KIT

Complete triple regulated power supply provides variable ±15 volts at 200 mA and +5 volts at 1 Amp. 50 mV load regulation good filtering and small size. Kit less transformers. Requires 6-8 V at 1 Amp and 18 to 30 VCT.

Complete Kit, PS-3LT $6.95

DECADE COUNTER PARTS KIT

INCLUDES $3.50
- 7490A decade counter
- 7475 latch
- 7447 LED driver
- LED readout
- Current limit resistors

Complete with instruction and details on how to build an easy, low cost freq. counter. R8

SEE YOU IN ATLANTA – HAMFESTIVAL JUNE 18 & 19

2 meter CRYSTALS

for these radios

FREQUENCIES IN STOCK

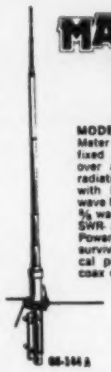
146.01T
6.61R
6.04T
6.64R
6.07T
6.67R
6.10T
6.70R
6.115T
6.715R
6.13T
6.73R
6.145T
6.745R
6.616T
6.76R
6.175T
6.775R
6.19T
6.79R
6.22T
6.82R
6.25T
6.85R
6.28T
6.88R
6.31T
6.91R
6.34T
6.94R
6.37T
6.97R
6.40T
6.46T
6.46R
6.52T
6.52R
6.55T
6.55R
6.58T
6.58R
6.94T
7.60T
7.00R
7.63T
7.03R
7.66T
7.06R
7.69T
7.09R
7.72T
7.12R
7.75T
7.15R
7.78T
7.18R
7.81T
7.21R
7.84T
7.24R
7.87T
7.27R
7.90T
7.30R
7.93T
7.33R
7.96T
7.36R
7.99T
7.39R

Clegg HT-146
Drake TR-22
Drake TR-33 rec only
Drake TR-72
Genave
Heathkit HW-2021 rec only
Heathkit HW-202
Icom/VHF Eng
Ken/Wilson
Lafayette HA-146
Midland 13-505
Regency HR-2, A
Regency HR-212
Regency HR-2B
Regency HR-312
Regency HR-2MS
S.B.E.
Sonar 1802-3-4, 3601
Standard 146/826
Standard Horizon
Swan FM 2X
Tempo FMH
Trio/Kenwood TR2200
Trio/Kenwood TR7200

Note: If you do not know type of radio, or if your radio is not listed, give fundamental frequency, formula and loading capacitance.

CRYSTALS FOR THE IC-230 SPLITS IN STOCK: 13.851111 MHz; 13.884444 MHz; 13.917778 MHz; HEATHKIT HW2021 600 KHz. OFFSET 11.3 MHz; $6.50 ea.

MASTER GAINER



MODEL GG-144A — Deluxe, Two-Meter Colinear for Repeater or any fixed station operation. 6 db. gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator: ⅝ wave lower section, ¼ wave phasing, ⅝ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¾" O.D. SO-239 coax connector **$52.95**

SUPER GAIN MOBILES

Two Meters

- 5.2 db gain over 1/4 wave mobile antenna
- Frequency coverage—143-149 MHz
- SWR at resonance—1.1:1 typical
- Power rating—200 watts FM

CB 144

MODEL CG-144 Same characteristics as CGT-144 supplied with ⅜"-24 base to fit all mobile ball mounts—Length is 85". Mount and cable not included. **$26.75**

HUSTLER

VHF/UHF ANTENNA—ROOF MOUNT
MODEL UHT-1
Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ⅜" hole. Includes 15' RG-58-U. **$10.15**

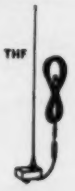
STANDARD GAIN MOBILES

Two Meters

- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—50 watts FM

MODEL BBLT-144
47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount. **$28.75**

MODEL BBL-144
47" antenna mounts on any flat surface, roof, deck or fender in ¾" hole. Includes impact spring, 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount. **$26.95**



VHF/UHF ANTENNA—TRUNK LIP MOUNT
MODEL THF
Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259. **$15.95**

HUSTLER "BUCK-BUSTER"

MODEL BF-2
51" two meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ⅜"-24 base to fit your mount or a wide selection of Hustler mobile mounts. (Mount or cable not included). **$12.75**

BF-2

MODEL HLM
Deluxe trunk lip mount with 180 degree swivel ball for positioning antenna to vertical. Easy — no holes — installation. Includes 17' RG-58 U cable and connectors attached. **$14.85**

DELUXE MOBILE MOUNTS

For medium length, light weight antennas with ⅜" — 24 base.

MODEL TLM
Trunk lip mount for no holes installation on side or edge of trunk lid. Includes 17' RG-58-U connectors attached. **$12.05**

MODEL GCM-1
Rain gutter mount fits all shapes, angles even latest trim line gutters. Includes 180° swivel ball. **$7.50**

VHF AMATEUR ANTENNAS

Each Hustler antenna design is specifically optimized for amateur band performance. Every assembly is manufactured from the best available materials under carefully controlled quality standards to give you superior mechanical and electrical performance. For more than a decade, reliability has been our foremost desire!

SHIPPING

We can ship C.O.D. first class mail. Orders can be paid by: check, money order, Master Charge, or Bank Americard. Orders prepaid are shipped postage paid. Phone orders accepted. Crystals are guaranteed for life. Crystals are all $5.00 each (Mass. residents add 25¢ tax per crystal). U.S. FUNDS ONLY

We ship COD first class mail. Prepaid orders are postpaid by us. Use check, money order, BAC or MC in U.S. funds.

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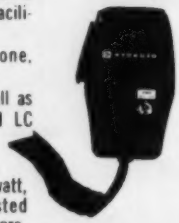
NEW!
FM144-10SXRII

All Solid State-PLL digital synthesized — No Crystals to buy! 5KHz steps — 144–149 MHz-LED digital readout PLUS MARS-CAP.*

• 5MHz Band Coverage — 1000 Channels (instead of the usual 2MHz to 4MHz — 400 to 800 Channels) • Priority Channel • Audio Output 4 Watts • 15 Watts Output • Unequaled Receiver Sensitivity and Selectivity — 15 POLE FILTER, MONOLITHIC CRYSTAL FILTER AND AUTOMATIC TUNED RECEIVER FRONT END — COMPARE!! • Superb Engineering and Superior Commercial Avionics Grade Quality and Construction Second to None at ANY PRICE.

- **FREQUENCY RANGE:** Receive: 144.00 to 148.995 MHz, 5KHz steps (1000 channels). Transmit 144.00 to 148.995 MHz, 5KHz steps (1000 channels) + MARS-CAP.*
- **FULL DIGITAL READOUT:** Six easy to read LED digits provide direct frequency readout assuring accurate and simple selection of operating frequency.
- **AIRCRAFT TYPE FREQUENCY SELECTOR:** Large and small coaxially mounted knobs select 100KHz and 10KHz steps respectively. Switches click-stopped with a home position facilitate frequency changing without need to view LED'S while driving and provides the sightless amateur with full Braille dial as standard equipment.
- **FULL AUTOMATIC TUNING OF RECEIVER FRONT END:** DC output of PLL fed to varactor diodes in all front end R-F tuned circuits provides full sensitivity and optimum intermodulation rejection over the entire band. **No other amateur unit at any price** has this feature which is found in only the most sophisticated and expensive aircraft and commercial transceivers.
- **TRUE FM:** Not phase modulation — for superb emphasized hi-fi audio quality second to none.
- **FULLY REGULATED INTEGRAL POWER SUPPLIES:** Operating voltage for all circuits, i.e., 12v, 9v and 5v have independently regulated supplies. 12v regulator effective in keeping engine alternator noises out and protects final transistor from overload.
- **MONITOR LAMPS:** 2 LED'S on front panel indicate (1) incoming signal-channel busy, and (2) un-lock condition of phase locked loop.
- **DUPLEX FREQUENCY OFFSET:** 600KHz **plus** or **minus**, 5KHz steps. Plus simplex, any frequency.
- **MODULAR COMMERCIAL GRADE CONSTRUCTION:** 6 unitized modules eliminate stray coupling and facilitate ease of maintenance.
- **ACCESSORY SOCKET:** Fully wired for touch-tone, phone patch, and other accessories.
- **RECEIVE:** .25 uv sensitivity. **15 pole filter** as well as monolithic crystal filter and **automatic tuned** LC circuits provide superior skirt selectivity.
- **AUDIO OUTPUT: 4 WATTS.** Built in speaker.
- **HIGH/LOW POWER OUTPUT:** 15 watts and 1 watt, switch selected. Low power may be adjusted anywhere between 1 watt and 15 watts, fully protected — short or open SWR.
- **PRIORITY CHANNEL:** Instant selection by front panel switch. Diode matrix may be owner re-programmed to any frequency (146.52 provided).
- **DUAL METER:** Provides "S" reading on receive and power out on transmit.
- **OTHER FEATURES:** Dynamic microphone, mobile mount, external speaker jack, and much, much, more. Size: 2⅛ x 6½ x 7½. All cords, plugs, fuses, mobile mount, microphone hanger, etc., included. Weight: 5 lbs.



NEW! 6 METER FM50-10SXRII

Same specifications as above except transmit/receive: 51.00-53.995 MHz. 600 channels
Introductory Price $389.00

SUMMER SPECIAL
FM144-10SXRII
$389.00
VALUE $599.00
Regulated AC/PS
Model FMPS-4R ... $49.00

NEW!
TONE ENCODER/ DECODER

SC-12A ... 12 CHANNELS ... DUAL TONE
Introductory Price $119.00

Touch-Tone Pad
MODEL FMTP-1
... $59.00

Manufactured by one of the world's most distinguished Avionics manufacturers, Kyokuto Denshi Kaisha, Ltd.

First in the world with an all solid state 2 meter FM transceiver.

AMATEUR-WHOLESALE ELECTRONICS

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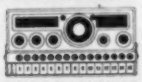
PLEASE ORDER FROM YOUR LOCAL DEALER OR DIRECT IF UNAVAILABLE.

Regional Sales & Service Centers:
Northeast: Buzzards Bay Electronics Buzzards Bay, Mass.
East: Sanford Communications, Inc. Colonia, N.J.
West: Consumer Communications, Inc. Seattle, Wash.

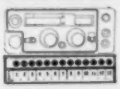
NEW!
FMSC-2 SCANNER
FOR KDK FM-144



14 CHANNEL PROGRAMABLE
INTRODUCTORY PRICE **$99**

NEW! 7400 SCANNER

FOR KENWOOD TR-7400A



14 CHANNEL PROGRAMABLE
INTRODUCTORY PRICE **$99**

***NEW**

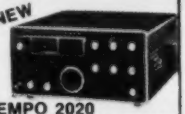
$39.95

NEW!! ADD 5 CHANS (TOTAL 10) TO SRC-146A

- Simple 10 min. installation
- Same color and quality as SRC-146A
- Completely WIRED & TESTED
- ALSO usable with most other hand helds **$39.95**

ATLAS, COLLINS, REGENCY, DENTRON, BRIMSTONE, CUSHCRAFT, BIRD, STANDARD, KLM, HYGAIN, KENWOOD, TEMPO, MINI-PRODUCTS, MIDLAND, VHF MARINE, EIMAC, ICOM, AMMCOM, CIR, ETC. — PLEASE WRITE FOR QUOTE.

***NEW**



TEMPO 2020

A BRILLIANT NEW SSB TRANSCEIVER PROVIDING AN UNBEATABLE COMBINATION OF ADVANCED ENGINEERING AND UNIQUE OPERATING FEATURES.

PLEASE WRITE FOR COMPLETE INFORMATION.

STANDARD TRANSCEIVER MODEL SRC-146A

***NEW!**

NEW!! TOUCH-TONE PAD COMPLETELY WIRED & READY TO PLUG IN $69.00 COMPLETE BACK ASSEMBLY

YAESU FT-101E TRANSCEIVER'S

Please write for special deal.

NEW AM/FM ANALYZER

(Σ) SIGMA AF-250L

- INTRODUCTORY PRICE **$199**
- DEVIATION/MODULATION METER – FM: 0-20 KHz, AM: 0-100%.
- SIZE: 5½"(h) x 10¼"(w) x 7¼"(d). WEIGHT: 7 lbs.
- FREQUENCY: 1.8MHz-520MHz

ALSO MODEL AF-250LW WITH BUILT IN 125 WATT CALIBRATED WATT METER AND DUMMY LOAD. PRICE **$259**

PLEASE WRITE FOR COMPLETE INFORMATION

NEW! TWO NEW SCANNERS!

FMSC-1 SCANNER FOR KDK FM 144 AND 7400 SCANNER II for Trio-Kenwood TR-7400A

FMSC-1 SCANNER **$169**
7400 SCANNER II **$189**

- Full scan 146 and 147 MHz consecutively or 1 MHz, or any MHz range • Scan rate: 1 MHz/2 seconds (adjustable) • Controls: Scan/Hold, Latch/Delay, 600 KHz offset (off, up, down), program/1 MHz • Simple installation.

NEW— CDR HAM II ROTATORS Reg. $159.95 **$125.00**

PLEASE WRITE FOR SPECIAL BONUS AND PACKAGE OFFERS.

ATLAS
210X-215X AND 350-XL

STANDARD
NEW 2 METER FM TRANSCEIVERS
Model SRC-146A

SPECIAL SALE!

- SRC 146A $298.00
- 4 XTALS: 34/94 AND 94/94 N/C
- USA-2 DELUXE BASE CHARGER $40.00
- PT3644 LEATHER CASE $10.00
- AT-19 RUBBER ANT. AND WHIP $6.00
- NI-CADS $30.00

* NEW! TOUCH TONE PAD COMPLETELY WIRED & READY TO PLUG IN $69.00 — REGULAR $384.00 **OUR PRICE $279.00** Quantities Limited

the indispensable BIRD 43 THRULINE WATTMETER

AUTHORIZED BIRD DISTRIBUTOR

(Σ) SIGMA RF-2000 SWR & POWER METER

INTRODUCTORY PRICE **$29**

CAL. PWR. SCALES 200W/2000W

- FREQ. RANGE 3.5 - 150 MHz
- PLEASE DO NOT CONFUSE THE RF-2000 WITH SIMILAR APPEARING LOWER PRICED UNITS – RF-2000 IS AN INDIVIDUALLY CALIBRATED PROFESSIONAL QUALITY INSTRUMENT – UNEQUALED AT MANY TIMES THE PRICE.

SIZE: 7"(w) x 2½"(h) x 2½"(d).

NEW! (Σ)

SIGMA XR-3000D LINEAR AMPLIFIER

INTRODUCTORY PRICE $789

2 DAY AIR SHIPMENT ANYWHERE IN U.S. $35. ALASKA AND HAWAII SLIGHTLY HIGHER.

- FULL BAND COVERAGE 160-10 METERS INCLUDING MARS.
- 2000+ WATTS P.E.P. SSB INPUT. 1000 WATTS INPUT CONTINUOUS DUTY, CW, RTTY AND SSTV.
- TWO EIMAC 3-500Z CONSERVATIVELY RATED FINALS.
- ALL MAJOR HV AND OTHER CIRCUIT COMPONENTS MOUNTED ON SINGLE G-10 GLASS PLUG IN BOARD. HAVE A SERVICE PROBLEM? (VERY UNLIKELY) JUST UNPLUG BOARD AND SEND TO US.
- HEAVY DUTY COMMERCIAL GRADE QUALITY AND CONSTRUCTION SECOND TO **NO OTHER UNIT AT ANY PRICE!**
- WEIGHT: 90 lbs. SIZE: 9½"(h) x 16"(w) x 15¾"(d).

FEATURES

CUSTOM COMPUTER GRADE COMMERCIAL COMPONENTS, CAPACITORS, AND TUBE SOCKETS MANUFACTURED ESPECIALLY FOR HIGH POWER USE — HEAVY DUTY 10KW SILVER PLATED CERAMIC BAND SWITCHES • SILVER PLATED COPPER TUBING TANK COIL • HUGH 4" EASY TO READ METERS — MEASURE PLATE CURRENT, HIGH VOLTAGE, GRID CURRENT, AND RELATIVE RF OUTPUT • CONTINUOUS DUTY POWER SUPPLY BUILT IN • STATE OF THE ART ZENER DIODE STANDBY AND OPERATING BIAS PROVIDES REDUCED IDLING CURRENT AND GREATER OUTPUT EFFICIENCY • BUILT IN HUM FREE DC HEAVY DUTY ANTENNA CHANGE-OVER RELAYS • AC INPUT 110V OR 220V AC, 50-60Hz • TUNED INPUT CIRCUITS • ALC-REAR PANEL CONNECTIONS FOR ALC OUTPUT TO EXCITER AND FOR RELAY CONTROL • DOUBLE INTERNAL SHIELDING OF ALL RF ENCLOSURES • HEAVY DUTY CHASSIS AND CABINET CONSTRUCTION AND MUCH, MUCH MORE.

ASTRO 200

AMMCOM S 2 25

CIR TRANSCEIVERS

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KDK

ACCESSORIES FOR KDK FM 144

FMPS-4R	Regulated AC/PS	$49
FMTP-1	Touch Tone Pad	$59
FMTP-2	Touch Tone Pad with 10 Number Programable Memory	$99
FMMC-1	Microphone with Built-in Touch Tone Pad	$59
FMTD-1	Private Call Decoder for use with and Programed by Any Touch Tone Pad	$129
SC-12A	Audible Tone Encoder Decoder	$119
FMSC-1	Scanner – Random, Any Range	$169
FMSC-2	Scanner – Programable, 14 Channels	$99
MARS-CAP*	Option Kit – Any Frequency, Any Split	$12
FMOF-1	Offset Option Kit – 2 Extra Positions, Crystals Required	$19
FMOF-2	±1 MHz Offset Option Kit (No Crystals To Buy)	$19
FMTE-1	Sub Audible Tone (100 Hz – Adjustable 67-203 Hz)	$29
FMAT-1	½ Wave Portable Antenna for Hotel, Motel or Apartment	$7.95
Extra DC Cord & Plug		$3.50
ACC. Socket 5 Pin Din Plug		$1.50
Owners Manual		$5.00
Service Manual		$2.00
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S. I. GREGORY—WA4KGU, Owner/Gen. Mgr.

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HAPPY BIRTHDAY BULLET!

This month we are two years old. We are going to have a party and YOU are invited. It's just our way of saying "thank-you" to all our customers for helping us grow as much as we have.

The **OVP-1** is an overvoltage protection circuit designed to protect your expensive gear if the series pass regulators short or unauthorized hands tamper with the voltage setting on a variable supply. Set the OVP-1 for 1 or 2 volts over the normal operating voltage and it will instantly fire a 25A SCR and short the output to ground causing the supply to go into current limiting; (if the supply has this feature), or blow the fuse. The kit comes complete with PC board, all components including the 25A SCR, complete instructions for **$6.95.** Compatible with the PS-12 Power Supply Kit.

SPECIAL DEAL NO. 1 – Buy a PS-12 3-30 volt @ 10A supply for $49.95. Take a 10% discount for an order over $50.00 and we will send you the OVP-1 **FREE!** Your total cost $44.95 plus $3.70 shipping! (Canadian customers add $10.00 for parcel post shipping and insurance.)

SPECIAL DEAL NO. 2 – Buy 2 **CDI** Kits for $9.95 each and get the third one for $1.00

SPECIAL DEAL NO. 3 – Buy 4 **Warble Alarm kits** and get one **FREE!**

SPECIAL DEAL NO. 4 – TB-03/60hz TIME BASE KIT. Ceramic resonator gives this unit good stability and accuracy at low cost. Complete with PC board and all parts. Buffered output, better than .01% accuracy. Buy 2 for $5.95 each, get the third kit **FREE!**

SPECIAL DEAL NO. 5 – TB-03/50hz TIME BASE KIT. Want your mostek 50250 alarm clock chip to read in 24 hour format? This unit provides 50hz at .01% accuracy. Buy 2 for $5.95 each, get the third kit **FREE!**

OFFER GOOD THRU JUNE 30, 1977 ON SPECIAL DEALS 1 – 5. ORDERS RECEIVED MUST BE POSTMARKED NO LATER THAN THIS DATE TO RECEIVE DISCOUNTS. ANY ORDER RECEIVED POSTMARKED AFTER JUNE 30, 1977 WILL BE CHARGED FULL PRICE.

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SPECIAL DEAL NO. 6 – 565 PLL IC's LIMITED QUANTITY While they last...**49c each**

SPECIAL DEAL NO. 7 – MC1351 IC's wide band FM amp; limiter, Detector and Audio Amp. One 14 pin dip package (staggered leads) House numbered **99c each**

SPECIAL DEAL NO. 8 – 741 MINI DIP's Useful in hundreds of projects **5/99c**

NO TIME LIMIT FOR PURCHASE ON ITEMS 6 – 8

WE BET THAT WE CAN SHIP ANYTHING IN THIS AD WITHIN 48 HOURS OF RECEIPT OF YOUR ORDER. If we lose we will still send your order and we will also send you a brand new silver* dollar for every $5.00 in merchandise you ordered!

IF WE WIN WE GET TO KEEP YOU AS A SATISFIED CUSTOMER...

WANTA' BET??

*Silver dollars are new copper clad style. Refunds are calculated on nearest $5.00 increment. Sundays and holidays are excluded.

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(214) 823-3240

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- Add 5% for Shipping
- Tex. Res. add 5% Sales Tax
- Foreign Orders add 10% (20% for Airmail)

- Order under $10. add 60c handling
- Accepting phone orders on MC & BAC
- Catalog free with each order.

DON'T FORGET! 10% discount on merchandise orders of $50.00 and over.

No other clock at any price has all these features:

MINI GRANDFATHER CLOCK KIT

$39.95
(order MG-01)
Case NOT included
$49.95
(order MG-01/A)
Completely assembled!
(Case NOT included)

We offer a beautiful solid hard wood case in either ash or walnut with front ruby filter. Designed and cut specifically for the mini grandfather clock kit.
Unfinished Case – $14.95
Finished Case – $18.50
Please specify type of wood desired. Case is shipped unassembled.

This quality time piece will catch the eye of everybody who walks into your house! It will be the most unique item on your mantle or bookshelf.

$39.95

- Completely Electronic
- 100% Solid State
- All CMOS IC Construction
- 2 Quality Plated PC Boards 6.5 x 4.5"
- New, revised easy to follow instructions
- Large ½" LED readout with AM/PM & colon indicators
- Simulated LED swinging pendulum with syncronized tick-tock sound.
- Chimes the hour (ie: 3 times for 3 o'clock
- Adjustable volume tone and sustain on the chime.
- LOW COST
- Complete with all parts including transformer & Speaker

WE BACK YOU UP!
Bullet will repair any kit we have ever sold for 20% of original purchase price to cover handling. (Warranty void for improper soldering techniques.)

AUTOMATIC TIME-OUT CIRCUIT

For use with the US-01 or any other application. Provides a 17 second entry delay and then energizes your alarm for approx. 10 minutes; rearms itself. Will source up to 200ma to drive a relay. All components & PC board.

$3.95

ULTRASONIC SENDER-RECEIVER KIT

A special buy on a high quality ultrasonic transducer allows us to offer this kit at a super price. Gives you the basics to build INTRUSION ALARMS, MOTION DETECTORS, REMOTE CONTROLS, ECHO RANGING, etc. All components with drilled & plated PC Board. Will cover up to 400 sq. ft. Requires 12-15VDC @ 80 ma (not supplied). Order model US-01.

$19.95

WARBLE ALARM KIT

Thousands of these are being used in scores of applications. Gives a LOUD two tone scream of 10 watts (pulsed) power. Requires 6-15VDC@ 800ma & 4 or 8 ohm speaker. (spk. not supplied) **$2.50 includes all components & PC Board**

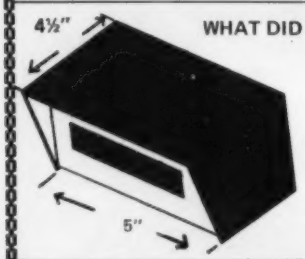
THE PS-12/A IS THE BEST POWER SUPPLY KIT ON THE MARKET FOR *49.95. PERIOD!

CHECK THESE SPECS:
- 3 to 16 volts and 15 to 30 volts (2 ranges)
- Adjustable fold back current limiting from 4 to 15 amps.
- 10 amps continuous, 15 amps with fan cooling.
- Regulation better than 150mv from 0 to full load
- Ripple less than 200mv @ 10 amps
- Short circuit protection

LOOK WHAT YOU GET:
- 11 pound heavy duty transformer
- Two 6" 60 watt heatsinks
- All resistors, caps, etc.
- Large computer grade filter cap
- IC regulator, power transistors and 15A bridge rectifier.
- Quality plated and drilled PC board

$49.95

Price does not include case, meters, or jacks.
*** Add $3.70 for UPS shipping.**



WHAT DID YOU DO WITH YOUR $9.95 LED CLOCK?

Put it in a quality custom metal shadow front case.

- Black baked enamel wrinkle finish
- Pre-punched front slot
- Ruby filter
- L brackets & hardware for mounting your clock

$4.75

FIRED UP!

Our CDI Kit will give your car that extra spark it needs to burn fuel more efficiently. A special buy allows us to sell the complete kit at a low, low price. $9.95
Includes: Special toroid transformer, drilled & plated PC board, all components, and complete instructions. (Heatsink and case NOT provided.)

$9.95

THE DOOMSDAY ALARM
$8.50

Four independently adjustable oscillators are sequentially mixed and disabled by a counter circuit pulsing at a rate that you set. The sound combinations are endless and the effect is amazing. Sounds straight from the Twilight Zone. Complete electronics with plated PC board. Requires 6 to 15 volts DC @ 800ma. 10 watts (pulsed) @ 8 ohms and 12 volts. Order: DA-01 **$8.50**

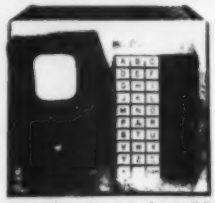
SMILIN' JACK ..... YOU NEVER HAD IT SO GOOD!

Separate 24 hour real time clock and up to 24 hours elapsed time displayed independently on the same set of six .4" LED readouts. Clock has presettable alarm with 10 minute snooze. Timer has reset, hold and count functions. Full noise and overvoltage protection. Because of the many options and mounting variations the kit is sold less the case and switches.

MK-03 **$26.95** 9 to 14 VDC

Will fit inside standard aircraft instrument case.

INPUT/OUTPUT TERMINAL



A great place to start for building a microprocessor. These units were part of a comiex computer system. The terminal contains: keyboard; CRT; drive circuits; ASC11 output; and a complete 128 page technical manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. (Character generator was part of a separate control section which is not supplied. The terminal can be used when modified using character generator LSI chips, such as the 2513, 2516 or other such IC's).

The keyboard is a 50 key alpha-numeric (and others) block keyboard, with ASC11 output. Display capactiy is 768 (12 lines of 64), 384, 256, 128 and so on, depending on character size desired. The character size may be adjusted from approximately typewriter size up to ¼".

The viewing screen of the CRT utilizes a high contrast, low persistence, emerald green phosphor. Each character is composed from a 5 x 7 dot pattern, registering clearly and sharply against a dark background. Controls provided include: on/off; brightness; focus; and character height.

Great as a microprocessor input & output device. The display stations are used, removed from airline reservation systems, hotel reservation systems, stock exchanges, etc. Sh. Wt. 35 Lbs.

NEVER BEFORE at this LOW PRICE!

6NB60336 . . . . . .$34.50

DRINK MIXER KIT

A real old-fashioned type like the kind at the local drug store back in the 1950's, except that these are brand new parts. Through a lucky purchase we have obtained some new parts of a drink mixer. It is complete but for the top cover, but you can make your own or operate without it. Evidently the manufacturer sold this line out to another and the tops got lost. Now you can build up a $20.00 mixer for under $5.00. Kids love 'em, order one today! Kit includes motor, mixer, screws, stand, line cord, switch, and 16 oz mixer cup. . . . . .Sh. Wt. 5 Lbs.

7M370053 . . . . . .$4.88

ALSO: Spare Mixer Cup for above

Sh. Wt. 8 oz. . . 7M370054 . . $1.25 ea.

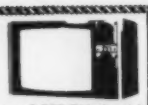
LOGIC AND OP AMP POWER SUPPLY

This regulated power supply has outputs of ±15 volts at 0.25 amps and +5 volts at 2.5 amps, with an input of 115 VAC. Manufactured by a computer company as part of a phone data terminal. Three (3) 723's (IC's) are used for voltage regulation. Units have barrier strip outputs, and are open frame. Size: 5" x 9" x 2". New surplus. Qty. Ltd.

Sh. Wt. 5 Lbs . . . 6MI60215 . . .$17.50

3 for $45.00. . . 6MI60215 . . $45.00/3

COLOR T.V. CHASSIS



We have found some 2,000 TV chassis' that got damaged in a train derailment. These are the very same types of chassis' we have been selling: the TS-951 and the TS-953. We have sold over 2,000 of the perfect chassis and now we have a quantity that do not measure up to our high standards. They have cracked P.C. boards, bent frames, etc., but they are worth 3 times as much for the fantastic parts.

13" and 15" chassis' include tuners and controls. All chassis' sold "AS IS", all sales are final, no returns please.

13" Chassis . . 7JZ70059 . . .$22.50 ea.
Sh. Wt. 12 Lbs. ea. 10 for $198.00

15" Chassis . . 7DZ70060 . . .$22.50 ea.
Sh. Wt. 12 Lbs. ea. 10 for $198.00

17" Chassis . . . 7DZ70061 . . . .$14.88
Sh. Wt. 10 Lbs. ea. 10 for $128.88

19" Chassis . . . 7DZ70061 . . . .$14.88
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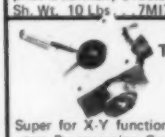
MAGNETIC CREDIT CARD READER

Unique item was designed to transport and read credit card "ABA" information. Reads ABA track at 75 bits per inch and up to 250 bits across the card. Adaptable to IATA, ABA and Thrift Track requirements. Unit contains: motor; read head; read amplifier board; motor control board and mechanism. Requires 15 VDC power source. Use this to decode credit cards and put information into your computer or microprocessor. Quantity is limited. New, packaged and complete with 18 page technical data package. List price is normally $156.00.

Sh. Wt. 10 Lbs . . . 7MI70012 . . . $39.50

JOYSTICKS Two 10K POT'S



Super for X-Y functions: Audio, Computers, Programming, Graphics, etc.

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New surplus boxed "ITT" keyboard, just the thing to make your own touch-tone phone or repeater. You can use these with our dialer chips ME 8900, MC 14410 or our Auto Dialer kit No. 6MI60189. Supplied with typical applications circuit diagrams.

Sh. Wt. 8 oz. . . . . 7MI70162 . . . .$5.88
3 for $17.00. . . 7MI70162 . . $17.00/3

GTE (AE) Used Touch-Tone Keyboard
Sh. Wt. 1 Lb . . . .6MI60182 . . . .$5.00

Chomerics Touch-Tone Keyboard - New
Sh. Wt. 8 oz. . . . 5MI00349 . . . .$4.50

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MODERN STANDARD TELEPHONES

A complete, factory rebuilt, modern telephone ready for instant use. Available in black, white, beige, pink, red, green and blue. Ideal as an extra phone, for use on intercoms, private systems, extensions, etc. Easy 2-wire hook-up. Phones include hand set, induction coil, and cable, but no ringers. Many types and styles to choose from. When specifying a color, please give 3 choices in order of preference. Spec sheets with wiring diagrams are included, not detectable. Phones may vary slightly from photo. Sh. Wt. 8 Lbs.

(Call Director 10 line phone = 15 Lbs.)

† **Standard Desk Dial Phone**
Black, Desk Dial . . 6VL60440 . . $12.50

† **Standard Wall Dial Phone**
Color, Wall Dial. . . 6VL60443. . . $13.00

† **2 Line Standard Desk Dial Phone**
This phone has a twist key to switch in 2 lines over the same phone, plus a hold position. Available only in black.
Black, 2-Line . . . .6V60448 . . . .$24.50

SPECTRA STRIP RIBBON CABLE

You all know how valuable this stuff is . . and now it's available at a fraction of list price. Several types available, order by "SS" or "ST" number, number of feet desired.

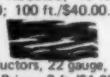
SS-1018: 10 conductor, 18 gauge. Prices: 3 ft./$1.00; 18 ft./$5.00; 40 ft./$10.00; 100 ft./$20.00.

SS-0822: 8 conductor, 22 gauge. Prices: 4 ft./$1.00; 20 ft./$5.00; 50 ft./$10.00; 100 ft./$17.00.

SS-1022: 10 conductor, 22 gauge. Prices: 6 ft./$1.00; 35 ft./$5.00; 80 ft./$10.00; 100 ft./$12.00; 200 ft./$22.00.

SS-1822-19BD-090: 18 conductors, 22 gauge, 19 strands, .090 thk. ground plane. Prices: 1 ft./$1.00; 6 ft./$5.00; 15 ft./$10.00; 50 ft./$25.00; 100 ft./$40.00.

SPECTRA TWIST RIBBON CABLE



ST-2422-7B: 24 conductors, 22 gauge, 7 strands per conductor. Prices: 3 ft./$1.25; 15 ft./$5.00; 35 ft./$10.00; 100 ft./$25.00; 500 ft./$100.00; 1,000 ft./$175.00.

3CT-5028-7B-05-125: Flat ribbon twist cable, used in place of shielded cable, reduces or eliminates cross-talk, 50 conductor, 28 gauge, 7 strands per cond. Prices: 1 ft./$1.25; 10 ft./$9.00; 50 ft./$40.00; 100 ft./$69.00; 500 ft./$300.00.

T.V. TENNIS GAME

1 or 2 players - Variable ball speed - dual paddle size - sound. These are questionable games returned to mfr. for one reason or another. He is too busy to repair, and needs mfg. room. His loss, your gain. Complete with schematic. Contains 20 - 74LS series chips, other chips, power supply & other stuff. 115VAC operation. Designed by MIT.

Sh. Wt. 4 Lbs. . . 7ZU70161 . . .$10.00
4 for $38.88. . 7ZU70160 . .$38.88 for 4

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CARD CAGE WITH GUIDES AND CONNECTORS

This cage has 37 PC board edge connectors for 1/16" thick cards. Connectors are wire wrap type with double edge contacts, 0.125" spacing. The card rack has 18 rows of 2 types of connectors: 30 contact and 85 contact types. Over-all dimensions: 18"L x 11"W x 10"H. Removed from used equipment, this was once part of a data display terminal.

Sh. Wt. 13 Lbs . . . .5U00210. . . .$9.50
3 for$25.00 . . . 5U00210 . . . $25.00/3

MICROPROCESSOR MAIN FRAME

Through a lucky purchase we have obtained a quantity of the main frames from the Viatron System 21 Computer. These contain the 5U00210 card cage mentioned above, plus five UG-90 connectors, male and female power supply connectors, display terminal base, etc. Looks ideal for building a microprocessor in. Possibilities unlimited!

Sh. Wt. 25 Lbs. . 68AE60129 . .$19.50
3 for $49.50. . . 68AE60129 . . $49.50

REGULATED 10 to 24 Volt DC 2 Amp POWER SUPPLY KIT GREAT FOR C.B.

Here's an easy to build kit, designed to give maximum RF output to your CB. Can be built to deliver 13.8 volts DC regulated (2A) for mobile CB's, or switched over to give 10 to 24 volts DC (2A) regulated, to be used as a lab bench supply. Kit includes all parts and instructions to put together this versatile power supply, case not included.

Includes printed circuit board.

Sh. Wt. 10 Lbs . . . 6C60498 . . .$14.88
3 for 38.98. . . . 6C60498 . . . $39.98/3

TOUCH-TONE GENERATOR CHIP ME 8900

New surplus tone generator chip: this one chip will generate dual frequency tones for a 2 in 8 code as used in all touch-tone phones. This chip can be interfaced into any telephone system. Operating voltage of 4.5 to 35 volts; no crystal required for freq. gen.; exceeds CCITT recommendations; data transmission capability. Chip is shipped complete with IC socket, a four page data sheet and a data package showing unique applications. Qty. Ltd.

Sh. Wt. 8 oz. . . . 7VL70160 . . . $6.95
10 for $60.00 . . 7VL70160 . .$60.00/10

CHARACTER GENERATORS MOS - ROM

The Mostek 6095 character generator

Features: 64 dot matrix (5x7) characters with column by column output; High speed character access time and column select access time; Completely static operation, no clocks required.

Applications: CRT alpha-numeric display; LED array driver; billboard and stock market displays.

Each ROM contains 2,240 bits of programmable storage, organized as 64 characters, each having 5 columns of 7 bits. Complete data sheet included.

Sh. Wt. 8 oz . . . . .7IC70020 . . . .$10.00
(Specify Mostek 6095 ROM & order no.)

FUNCTION GENERATOR CHIP INTEL 8038

New surplus from a local manufacturer who needed cash fast. You save!

Sh. Wt. 8 oz. . . . .7IC70167 . . . .$4.75
3 for $12.75. . . 7IC70167. . . $12.75/3
(Specify Intel 8038 with part number.)

B&F B4

SPECIAL PRICING!

PRIME - HIGH SPEED RAM

21L02-3 400 NS

LOW POWER - FACTORY FRESH

1-24	$1.95 ea	100-199	$1.60 ea
25-99	1.75 ea	200-499	1.45 ea

OVER 500 PCS. **1.39** ea.

PRINTED CIRCUIT BOARDS for CT-7001 Kits sold separately with assembly info. PC Boards are drilled Fiberglass, solder plated and screened with component layout.

Specify for 7001 *B, C or X - $7.95*

6-DIGIT LED CLOCK CALENDAR KIT

DATE-TIME-SNOOZE ALARM & MORE... KIT 7001

FOR THE BUILDER THAT WANTS THE BEST. FEATURING 12 OR 24 HOUR TIME — 29-30-31 DAY CALENDAR. ALARM, SNOOZE AND AUX. TIMER CIRCUITS

Will alternate time (8 seconds) and date (2 seconds) or may be wired for time or date display only, with other functions on demand. Has built-in oscillator for battery back-up. A loud 24 hour alarm with a repeatable 10 minute snooze alarm, alarm set & timer set indicators. Includes 110 VAC/60Hz power pack with cord and top quality components through-out.

KIT - 7001B WITH 6 - .5" DIGITS $39.95
KIT - 7001C WITH 4 - .6" DIGITS & 2 - .3" DIGITS FOR SECONDS $42.95
KIT - 7001X WITH 6 - .6" DIGITS $45.95

7001C DISPLAY

7001 X DISPLAY

7001 B DISPLAY

KITS ARE COMPLETE (LESS CABINET)

ALL 7001 KITS FIT CABINET I AND ACCEPT QUARTZ CRYSTAL TIME BASE KIT # TB-1

6 DIGIT LED CLOCK KIT #850-4

12/24 HR. OPERATION BIG .4" DIGITS - 50/60 HZ OPERATION

KIT INCLUDES
- INSTRUCTIONS
- QUALITY COMPONENTS
- 50 or 60 Hz OPERATION
- 12 or 24 HR OPERATION

6-LED Readouts (FND-359 Red, com. cathode)
1-MM5314 Clock Chip (24 pin)
13-Transistors
3-Switches
6-Capacitors
5-Diodes
9-Resistors
24-Molex pins

Kit #850-4 will fit Plexiglas Cabinet II

"Kit #850-4 will furnish a complete set of clock components as listed. The only additional items required are a 7-12 VAC transformer, a circuit board and a cabinet, if desired."

$11.95 ea. QTY. 1-5
$10.95 ea. QTY. 6-11
$9.95 ea. QTY. 12 OR MORE

PRINTED CIRCUIT BOARD FOR KIT #850-4, SCREEN PRINTED DRILLED AND SOLDER PLATED FIBERGLASS $2.95
MINI-BRITE RED LED'S (FOR COLON IN CLOCK DISPLAY) .... Pkg. of 5-$1.00
MOLDED PLUG TRANSFORMER 115/10 VAC (WITH CORD) $2.50

NOTE: Entire Clock may be assembled on one PC Board or Board may be cut to remote display.

MOBILE LED CLOCK

12/24 HR .4" DIGITS!

MODEL #2001

12 VOLT AC or DC POWERED

- 6 JUMBO .4" RED LED'S BEHIND RED FILTER LENS WITH CHROME RIM
- SET TIME FROM FRONT VIA HIDDEN SWITCHES • 12/24-Hr. TIME FORMAT
- STYLISH CHARCOAL GRAY CASE OF MOLDED HIGH TEMP. PLASTIC
- BRIDGE POWER INPUT CIRCUITRY — TWO WIRE NO POLARITY HOOK-UP
- OPTIONAL CONNECTION TO BLANK DISPLAY (Use When Key Off In Car, Etc.)
- TOP QUALITY PC BOARDS & COMPONENTS - EXCELLENT INSTRUCTIONS
- MOUNTING BRACKET INCLUDED

KIT #2001 COMPLETE KIT (Less 9V. Battery) **29.95** ea. 3 OR MORE **$27.95** ea.

115 VAC Power Pack #AC-1 **$2.00** ea.

ASSEMBLED UNITS WIRED & TESTED ORDER #2001 WT (LESS 9V. BATTERY) WIRED FOR 12 VAC OR .4" NOT SPECIFIED OTHERWISE **$39.95** ea. 3 OR MORE **$37.95** ea.

60 HZ. XTAL TIME BASE

Will enable Digital Clock Kits or Clock-Calendar Kits to operate from 12V DC. 1"x2" PC Board Power Req: 5-15V (2.5 MA. TYP.) Easy 3 wire hookup Accuracy: ± 2PPM

#TB-1 (Adjustable) Complete Kit **$4.95** ea

Wir & Cal $9.95

PLEXIGLAS CABINETS

Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.

CABINET I 3"H,6¼"W,5½"D — Black, White or Clear Cover

CABINET II 2½"H,5"W,4"D — $6.50 ea.

RED OR GREY PLEXIGLAS FOR DIGITAL BEZELS 3"x6"x1/8" 95¢ ea. 4/$3

SEE THE WORKS Clock Kit Clear Plexiglas Stand

- 6Big .4" digits
- 12 or 24 hr. time
- 3 set switches
- Plug transformer
- all parts included

Plexiglas is Pre-cut & drilled

Kit #850-4 CP

Size: 6"H,4½"W,3"D

$23.50 ea. **2/$45.** A SUPER CLOCK!

JUMBO DIGIT CLOCK

A complete Kit (less Cabinet) featuring: six .5" digits, MM5314 IC, 12/24 Hr. time, 50/60 HZ., Plug-Transformer, Line Cord, Switches, and all Parts. (Ideal Fit in Cabinet II) Kit # 5314-5 ... **$19.95** 2/$38.

WITH PC Board's

JUMBO DIGIT CONVERSION KIT $9.95 ea.

Convert small digit LED clock to large .5" displays. Kit includes 6 - LED's, Multiplex PC Board & easy hook-up info.

Kit # JD-1CC For common Cathode
Kit # JD-1CA for common Anode

TELEPHONE FORMAT KEYBOARD

BY Chomerics # EF-21360

2-1/4"x3"

5/32" thick

$4.95 6/$28.

25 AMP BRIDGE

$1.95 ea. 3/$5.00

NEW LSI TECHNOLOGY

FREQUENCY COUNTER KIT

8 LARGE .4" RED LED DIGITS

Kit #FC-50 • 8 IC's • XTAL TIME BASE

A truly "State of the Art" counter using quality components throughout.

KIT INCLUDES: DETAILED INSTRUCTIONS, XTAL, TOP QUALITY FIBERGLASS DOUBLE SIDED PC BOARD, IC'S WITH SOCKETS AND ALL PARTS LESS POWER SUPPLY AND CABINET.

50 MHZ COUNTER KIT	#FC-50	$69.95
5 VOLT REGULATED 1 AMP POWER SUPPLY KIT	#PS-02	$9.95
350 MHZ PRESCALER KIT	#PSL-350	23.95
850 MHZ PRESCALER KIT	#PSL-850	$29.95
CABINET [& MTG HARDWARE]	#CAB III	$19.95

[CABINET WILL HOUSE #FC-50, #PS-02, AND A PRESCALER]

Fairchild Super Digit FND-359

4" Char. Ht. 7 segment LED RED Com. Cath. Direct pin replacement for popular FND-70.

85¢ ea, 10/$8.50 100/$79.00

SET OF 6 FND-359 WITH MULTIPLEX PC BOARD $6.95

NYLON WIRE TIES

6" TIE-WRAP 100/$1.95
4" TIE-WRAP 100/$1.75

PLUG TRANSFORMERS

12 VAC at 150 MA	$ 2.50
12 VAC at 500 MA	3.50
7VAC at 1.75 VA	$3.50

SCHOTTKY TTL

74S00	$ .35
74S01	.40
74S04	.55
74S05	.60
74S08	.55
74S10	.40
74S20	.50
74S22	.45
74S40	.45
74S50	.45
74S51	.55
74S60	.55
74S64	.55
74S74	.65
74S75	1.75
74S78	1.50
74S86	.95
74S107	.95
74S112	.95
74S113	1.40
74S114	.95
74S133	.75
74S134	.75
74S138	1.75
74S139	1.50
74S151	1.95
74S153	1.95
74S156	1.95
74S158	1.95
74S157	1.80
74S159	2.50
74S174	2.50
74S175	2.50
74S181	2.95
74S182	1.95
74S251	2.75

DIGITAL CLOCK IC's

MM5312	$ 4.95
MM5314	3.95
MM5375 AB	3.95
CT-7001	7.95
CT-7002	13.95
MM5369	2.50

LED DRIVERS

7447	$ .95
7448	.95
75491	.65
75492	.65
9368	2.50

PRESCALE

11C90DC	$15.95
95H90	9.95

VOLTAGE REGULATORS

LM309 H	TO-5	$ .95
LM309 K	TO-3	1.25
7805	TAB	.95
7812	TAB	1.25
7812	TO-3	1.50
7815	TO-3	1.25
7815	TAB	1.25
78L15	TO-5	.75
7824	TO-3	1.25
723	DIP	.75
723	TO-5	.75

PROM

1702	E Prom $8.95
5203	E Prom $8.95

SPECIAL IC'S

7207A	INTERSIL
7208	INTERSIL
MC14553	MOT $ 9.95
MC14410	MOT $12.50
2513	SIG $ 9.95

IC SOCKETS

PINS	1-24	25	100
8	$ .25	$ .22	$ .20
14	.35	.32	.30
16	.28	.25	.23
18	.31	.28	.26
24	.50	.45	.40
28	.60	.55	.50
40	.75	.70	.65

XTAL

5.242880 MHZ. $4.95
3.579545 MHZ. $1.95

MOLEX PINS

$9.95 Reel of 1000 — 100 for $1.25

TRANSISTORS

2N2222 A	TO-18	3/$1.00
2N2712	TO-98	5/$1.00
2N3415	TO-9	5/$1.00
2N3704	TO-92	5/$1.00
2N4400	TO-92	5/$1.00
2N4125	TO-92	5/$1.00
2N4249	TO-92	5/$1.00
2N4437	PUT	2/$1.00
2N6027	PUT	2/$1.00
2N5457	N J-Fet	2/$1.00

DIODES

IN 4002	1A, 100 PIV	12/$1.00
IN 4005	1A, 600 PIV	11/$1.00
IN 4007	1A, 1000 PIV	10/$1.00
RECTIFIER	2.5A, 1000 PIV	4/$1.00
IN 914	SIL. SIGNAL	20/$1.00
IN 4148	SIL. SIGNAL	20/$1.00
DYAC	28V	4/$1.00

LINEAR

555	TIMER	2/$1.00
556	DUAL TIMER	.95
565	PLL	.95
566	FUNCTION GEN.	1.75
567	TONE DECODER	1.75

TRANSISTOR SOCKET TO-5/18 GOLD PINS

5-$1.00

7-SEG LED

COMMON CATHODE

	COLOR	HT	DEC PT	PRICE EA
FND 359	RED	.4"	RHDP	$ .95
FND 503	RED	.5"	RHDP	$1.35
DL 750	RED	.6"	LHDP	$2.95
XAN 654	GREEN	.6"	NDP	$1.95
XAN 664	RED	.6"	NDP	$1.95

COMMON ANODE

DL 747	RED	.6"	LHDP	$1.95
XAN-72	RED	.3"	LHDP	$1.25
MAN 72	RED	.3"	LHDP	$1.25
XAN 81	YELLOW	.3"	RHDP	$1.75
XAN 351	GREEN	.3"	RHDP	$1.50
XAN 362	ORANGE	.3"	LHDP	$1.50
XAN 682	RED	.6"	NDP	$1.95
XAN 692	RED	.6"	NDP	$1.95

OP AMPS

3/$1.00

301 TO-5
709 DIP
709 TO-5
741 DIP
741 M-DIP
741 TO-5
747 TO-5

DISCRETE LED's

JUMBO RED

10 FOR $1.00
100 FOR $9.50

PC TRIM POTS

25K 6/$1.00
4.7K 6/$1.00

SPECTROL 10K 10 TURN 99¢ 4/$3.00

CMOS

	ea.
4001	$ .20
4002	.20
4010	.40
4011	.20
4013	.40
4015	.95
4016	.40
4023	.20
4025	.20
4027	.40
4028	.85
4030	.35
4042	.75
4044	.60
4046	1.75
4049	.40
4050	.40

AUTO BURGLAR ALARM KIT

AN EASY TO ASSEMBLE AND EASY TO INSTALL ALARM PROVIDING MANY FEATURES NOT NORMALLY FOUND. KEYLESS ALARM HAS PROVISION FOR POS. & GROUNDING SWITCHES OR SENSORS. WILL PULSE HORN RELAY AT 1HZ RATE OR DRIVE SIREN. KIT PROVIDES PROGRAMMABLE TIME DELAYS FOR EXIT, ENTRY & ALARM PERIOD. UNIT MOUNTS UNDER DASH - REMOTE SWITCH CAN BE MOUNTED WHERE DESIRED. CMOS RELIABILITY RESISTS FALSE ALARMS & PROVIDES FOR ULTRA DEPENDABLE ALARM. DO NOT BE FOOLED BY LOW PRICES! THIS IS A TOP QUALITY COMPLETE KIT WITH ALL PARTS INCLUDING DETAILED DRAWINGS AND INSTRUCTIONS OR AVAILABLE WIRED AND TESTED.

KIT #ALR-1 $9.95

#ALR-1WT WIRED & TESTED $19.95

VARIABLE REGULATED 1 AMP POWER SUPPLY KIT

- VARIABLE FROM 4 to 14V
- SHORT CIRCUIT PROOF
- 723 IC REGULATOR
- 2N3055 PASS TRANSISTOR
- CURRENT LIMITING AT 1 Amp

KIT IS COMPLETE INCLUDING DRILLED & SOLDER PLATED FIBERGLASS PC BOARD AND ALL PARTS (Less TRANSFORMER) KIT #PS-01 $6.95

TRANSFORMER 24V CT will provide 300MA at 12V and 1 Amp at 5V. $3.50

OPTOELECTRONICS, INC.

BOX 219 • HOLLYWOOD, FLA. 33022 • (305) 921-2056
STORE: 823 S. 21 AVE.

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Orders Under $15 Add $1.00 Handling
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WE PAY ALL SHIPPING IN CONTINENTAL USA — OTHERS ADD 5% [10% FOR AIRMAIL]

SEE OUR BOOTHS AT THE ATLANTA HAMFESTIVAL - JUNE 18-19, 1977

New! Synthacoder

☆ ALL NEW SYNTHESIZER/ENCODER FROM ENGINEERING SPECIALITIES
THE ULTIMATE IN FREQUENCY CONTROL FOR IC-22S OWNERS!

No more soldering diodes every time you want to try a new repeater!
Just plug the Synthacoder into the back of your radio, select channel 22, and the Synthacoder takes command of your radio – Giving you fingertip control of ALL frequencies.

- Front Panel Thumbwheel Control of All Channels!
- Fully Automatic Invalid Code Control!
- Small Size: 3¾" x 1½" x 6"
- Factory Wired and Tested
- Easy To Install

SPECIAL
only $87.95
postpaid
CA Residents add 6% sales tax

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(805) 486-0817

☐ I'LL BITE! Please send more info.
☐ I'M HOOKED! Please RUSH my Synthacoder.

YES, I would like to purchase a Synthacoder for my IC-22S. Enclosed please find my $87.95 (Price includes postage and handling). California residents add 6% sales tax.

$_____ enclosed. ☐ Cash ☐ Check ☐ Money Order
Please charge my ☐ Master Charge ☐ BankAmericard
Credit card #_____
Interbank #_____
Expiration date_____
Signature _____

Name_____ Call_____
Address _____
City_____ State_____ Zip_____

E12

HOBB-Y-TRONIX, INC.

BIG-BRIGHT - .5" LED ALARM CLOCK
6 DIGIT AC or DC or ELAPSED TIMER KIT
$19.95 Complete

- PC Board Drilled & Silk Screened (Includes Xtal Time Base Circuitry)
- 5375 Nat. Clock Chip & Fairchild Displays
- Includes EVERY part required for clock and all options except Cabinet and Crystal Time Base components. If desired, see below.
- Brightness Control
- Freeze feat. on every mode
- Field Tested over 1 Yr.
- 24 Hr. Alarm w/snooze
- 0-60 Min. Elapsed Timer
- 12 Hr., 60 Hz oper.

Most Important — Complete Instructions, schematics Pictorials, layouts — everything for trouble free assembly
OPTION — XTAL Time Base Components - $2.95 when purchased w/clock

WOOD CLOCK CABINETS

Includes: Filter & Back
Walnut Grain or Black Leatherette Finish
$5.00 ea.

Dimensions (Inside)
A — 1-13/16"H, 5½"W, 4¾"D
B — 1⅜"H, 4¾"W, 4¾"D
Extra Filters — Red, Smoke Blue, Amber, & Green — $.60

AC/DC - ALARM Clock Kit - 12/24 Hr.

$7.50 quantities of 1-5 **$6.50** quantities of 6 & up

- **Your choice of Display Colors - Red, Green, Blue, Amber**
- Displays Hrs. & Min. - Switch to Min. & Secs. on Command.
- AM/PM Indication
- Field Tested for 6 months

The kit will include a 5316 National Clock Chip, 4 Flourescent Display tubes, all electronic components, switches, controls & complete instructions, specs, etc. for clock and all optional Features. Other parts required or if desired are as follows:

- PC Board, Drilled & Silk Screened $3.00
- Xformer (for AC oper.) — $1.00 App. (SCR output) timer kit — $2.00
- Speaker Alarm Kit — $2.00 CountDown (turn-off) timer kit — $2.00

CLOCK CHIPS

MM5314	$3.50
MM5316	3.50
MM5387 (Hi Cur. 5316)	3.95
MM5375	3.95
CT7001	7.95
CT7010	6.95

CRYSTALS

3.579545 MHZ	$1.95

DIODES

IN4001-IN4007 Mix	50 for 4.00
IN914 or IN4148	20 for 1.00
2.5 Amp 1000 Volts	5 for 1.00

LED DRIVERS

SN7447	.95
ITT200	.50
ITT201	.50

TRANSFORMERS

Plug type-12VAC 250MA	2.50
PC Mnt.-12VAC 250MA	1.50
Bkt Mnt.-5VAC 6 Amp.	4.95

IC SOCKETS

8 Pin	5 for 1.00
14 Pin	5 for 1.00
16 Pin	4 for 1.00
18 Pin	4 for 1.00
24 Pin	3 for 1.00
28 Pin	3 for 1.00
40 Pin	2 for 1.00

THE BIG ONE
.8" LED Alarm Clock Kit

Big Digits — Big Bargain Price

simple construction

$17.95 Complete

Includes:
Power Supply, Speaker, IC Socket
PC Board, Clock Chip, Switches
Fairchild .8" Display Module, xistors, resistors, capitors, Complete Instructions

Features:
- Hrs. & Min. Switch to Min. & Sec. on Command
- 12 Hr. - 24 Hr. Alarm
- 10 Min. Snooze
- AM/PM Indicators
- Sleep Output

7 SEG LED DISPLAYS

FND359 Common Cathode Red	$ .90
DL704/707 C.C./C.A. .33" Red	1.00
FND503/507 C.C./C.A. .50" Red	1.25
DL747/750 C.C./C.A. .60" Red	1.95
FND8000 C.C. .80" 4 Digit Mod. Red	4.50

SWITCHES

Pushbutton-Mom. On	3 for 1.00
Mini Toggle-SPDT	1.25
Mini Toggle-SPDT On-Center Off-Mom On	1.25
Mini Toggle-DPDT	1.50
Rocker SPDT	6 for 1.00
Rocker DPDT	5 for 1.00

The SUPER COMPACT
$13.95 Complete

Includes: All Parts, PC Board Power Supply & Case
Colors: Black, Silver, or Gold
Size: 4.75" x 1.8" x 1.4"
Material: Extruded Alum.

OPTION — Temperature Ind. Front Panel — $3.00

Features:
4-large .4" LED Displays
12/24 hour Format

60 HZ. CRYSTAL TIME BASE KIT
$4.95

Use with Digital Clocks for 12VDC or Portable Operation
KIT INCLUDES:
PC Board, 5369 Divider Chip
3.5795 MHZ XTAL &
All Other Parts
Complete Instructions

6 DIGIT LED MOBILE
Clock Kit & Elapsed Timer

.4" Digits 12 or 24 Hr.
Quartz Crystal Controlled
12 Volt DC or AC operation

$27.95 Complete
(less 9V battery)

- Protection from noise & High Impulses
- Display Blanking Capability
- Battery Back-Up Capability
- Size 4" x 1¾" x 4½"
- Rugged High Impact ABS
- Recessed Front Switches

OPTION — AC Adaptor $2.50

MA1003 (National) Mobile Clock Module .. $24.95

Voltage Regulators

Positive-To 220 Pkg.		Negative-To 220 Pkg.	
7805	$1.00	7905	$1.25
7806	1.00	7912	1.25
7812	1.00	7915	1.25
7815	1.00	**To-3 Pkg.**	
7824	1.00	LM309K	1.25

SPECIALS

Jumbo Red LED's	10 for 1.00 100 for 9.00
25 Pk. LED's Assid. Sizes & Colors	2.50
Bi-Polar LED Red/Green	1.00

Transistors		Bridges	
2N2222A	4/1.00	1½ Amp 200 volt	3/1.00
2N3904 type NPN	8/1.00	6 Amp 600 volt	3/2.00
2N3906 type PNP	8/1.00	25 Amp 200 volt	3/5.00
2N3055 (NPN,TO-3)	.75	**Prescalers**	
2N4904 (PNP,TO-3)	.85	95H90	8.95
SPRAGUE IC'S		11C90	14.95
ULN-3306M Dual Schmitt Trigger	.$.75 ea.	5 for $3.00	
ULN-2285 Audio Amp. 3-5 watts	$1.25 ea.	6 for 5.00	

6 Digit LED Stop-Watch Kit
Split Time $29.95 complete Taylor Time

FEATURES: Reads minutes, seconds, & 100ths of seconds
6 bright easily readable digits
Needs only 1 9 volt Xistor battery

KIT INCLUDES:
- Hand held case designed for above
- Latest Technology Intersil Mos Chip # 7205
- 3.2768 MHz Crystal
- Variable Trimmer Cap
- 2 mini slide & 3 MOM. PB Switches
- 3 pairs (6 digits) Double Digit LED Displays

P.C. BOARD for above

Blinky/Flasher/Timing Kit

$2.50 each **5 for $10.00**

Kit includes:
P.C. Board, 555 Timer, all components and a connector for a 9V Battery

COMPUTER CORNER

2102 Sig. or Fair	$1.35
	8 for 9.00
Memories: 2102-1 Sig. Hi Speed	1.50 ea.
	8 for 10.00
2112-1 Fair-Hi Speed-Low Pwr.	1.95
	8 for 12.00
Prom: 82S23	3.00
Microprocessor - 8080A	14.95

Ribbon Cable 28 gauge

	1-10 ft	10-25 ft	25-100 ft
12 to 20 conductor	.25/ft	.20/ft	.15/ft
24 to 36 conductor	.30/ft	.25/ft	.20/ft
40 to 50 conductor	.35/ft	.30/ft	.25/ft

Specify color cable desired-Gray, Blue, & Pink

Box 511, Edison, N.J. 08817

Orders must incl. Ck. - No COD's - Add $1.00 handling for orders under $25.00 - Outside Cont. USA add 5% Postage - 10% Air Mail - N.J. resid. add 5% Tax

SPECIAL - PULSE GENERATOR $80

Here is a remarkable deal on the Interdesign Model 1101 Pulse Generator. Orders must be postmarked before June 30th to qualify for this price; after that date, there will be an increase. Check these features: FULLY PORTABLE OPERATION---uses rechargeable batteries and charger (both included). Covers 0.1 Hz to 2 MHz in 7 switched, overlapping ranges, with a 20:1 frequency variation for each range. Duty cycle is variable from 10% to 90% of period minimum up to 200 KHz, and from 20% to 80% minimum up to 2 MHz.

This unit is fully triggerable for synchronization with other pulse trains. There is an additional trigger output, independent of amplitude or pulse width settings, for triggering oscilloscopes, counters, or other generators.

Output is equivalent to that of a TTL gate...in the high state, the source resistance is approximately 400 Ohms; in the low state, the impedance is less than 8 Ohms and can sink at least 50 mA. Specs on the output fall time are 10 nsec or .5% of period, whichever is greater. Rise time is 50 nsec or .5% of period, whichever is greater.

These units are new and attractively packaged in a sturdy dark blue and black case with white lettering. **We won't have these in stock forever so get your order in soon.**

FND503 FND510 READOUTS!

common cathode — common anode

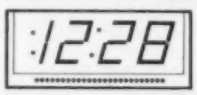
95¢ea. 10/$8.50

actual size 0.5"

50¢ ea. 10/$4 100/$35

FND359 0.4" actual size

Buy 3/$12.50 AND SAVE. Not a half inch type: these digits are **DIGI** AM/PM indicator, colon, and 3½ digits in a clear red plastic enclosure. Common cathode. **Ltd qty, subj. to prior sale.**



.8" digit clock display $4.95

74LS TTL

74LS00	$0.36	74LS139	1.38
74LS01	0.36	74LS155	1.38
74LS02	0.36	74LS157	1.25
74LS04	0.42	74LS160	1.85
74LS08	0.38	74LS161	1.85
74LS10	0.36	74LS162	1.85
74LS11	0.38	74LS163	1.85
74LS14	1.38	74LS168	1.87
74LS20	0.36	74LS169	1.87
74LS21	0.38	74LS174	1.38
74LS22	0.38	74LS175	1.35
74LS27	0.38	74LS221	1.38
74LS30	0.36	74LS240	1.88
74LS32	0.38	74LS257	1.25
74LS37	0.53	74LS258	1.36
74LS38	0.53	74LS273	2.25
74LS42	1.25	74LS283	1.20
74LS74	0.56	74LS367	1.00
74LS75	0.85	74LS368	1.00
74LS109	0.60	74LS377	1.88
74LS124	2.50	74LS378	1.38
74LS125	0.75	81LS95	1.13
74LS126	0.75	81LS96	1.13
74LS132	1.50	81LS97	1.13
74LS138	1.38	81LS98	1.13

Multi Meter

$14.99

- *6 DC Volt ranges
- *3 DC current
- *5 AC RMS ranges
- *2 ohms ranges
- *-20 to +22 dB
- *Includes 34" test leads
- *20KΩ/V DC
- *10KΩ/V AC
- *50 uA meter
- *Ohms adjust
- *5¼" x 3¼" x 1 5/8"

Requires 1 "AA" cell (not included). Please add $1 for shipping and handling.

HEY 73 READERS--get your order in by June 30th and mention 73, and you can take 10% off the cost of this meter.

Grandson of a cheap clock

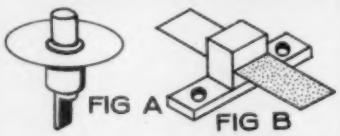
STILL $14.50 plus 1lb. post

Several years ago we introduced our "Cheap Clock", an unpretentious, inexpensive clock kit that has spawned numerous imitations...in the past few months, we've seen ads for "Cheapy Clocks", "Not a Cheap Clocks", and the like. Later, we upgraded our kit with bigger readouts, a bigger board, and brighter digits; we called it the "Son of a Cheap Clock". Now, we have taken that kit and again increased the digit size---to 0.4" this time. All other features are still there: 6 digit operation, separate driver and segment transistors, 12/24 hour operation, 50/60 Hz, industrial quality circuit board, sockets for IC and readouts to eliminate heat damage to semiconductors, and so on.

But most important of all...this is a complete clock kit, less only a case. Unlike many of our imitators who charge extra for a PC board and transformer, we include both items--as well as time-setting switches--in the package price. Our comprehensive data sheet includes instructions on using the clock for automotive applications, assembly procedure, and how to remote the readouts. All in all, this clock remains a superior value; despite the larger readouts and quality features, the price is not one penny higher than the "Son of a Cheap Clock".

We all know that imitation is the sincerest form of flattery, and to tell you the truth, we don't mind being flattered. But you may not enjoy the imitations...so if you're looking for a clock, look at ours for good value and no hidden costs.

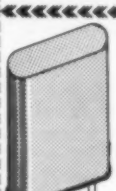
RF POWER TRANSISTORS



For operation at lower frequencies gain and efficiency are higher, giving higher output power.

PRICE	FIG.	Pd MAX @ 25°C	Pout MIN @ 2 GHz	Pin	EFFICIENCY @ 2.0 GHz	
$4.95	A	3.5W	1.0W	310mW	30%	sim RCA 2N5470
$5.95	B	8.7W	2.5W	300mW	33%	sim RCA TA8407
$6.95	B	21W	5.5W	1.25W	33%	sim RCA 2N6269
$7.95	B	29W	7.5W	1.5W	33%	factory select part--2N6269

CAVE Grafix



CRYSTALS

STATEK 3-lead xtals give .01% accuracy in a TO-5 can; use for fixed freq oscillators or with binary dividers to generate other freqs. Choose from (all freqs in KHz)

10.000	12.800	15.360	16.000	16.384	18.641	19.200	20.480	30.720
31.500	32.768	38.400	40.960	60.000	76.800	100.00	153.60	240.00

ALL STATEK CRYSTALS ARE $5 EACH.

The following crystals are series mode, fundamental, with wire leads...for hams and computer bugs. Choose from 4, 5, 8, 9, 10, 12, 15, 18, and 20 MHz (all $5 each). **Also available:** 500 KHz ($5), 1 MHz ($6), and 2 MHz ($5.50).

$5.00

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We knew it had to come to this some day, what with CAVE Grafix being T-shirt fanatics: so here it is, our very own T-shirt. It's 100% cotton, fully washable, and made by Haynes...so you know it's good. Specify small, medium, or large.

12V 8A supply $39.95

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Whether you use it for a bench supply...or ham transceivers... or for CB, you will love the features of this powerful supply. It's easy to build and compact --- everything except the xfrmr/bridge/caps combination mounts on a single circuit board, and that includes heat sinks. But it's after the assembly job is done that you appreciate the specs: crowbar overvoltage protection, 0.05 Volt regulation, 12 Amp capability with 50% duty cycle loading, and RF bypassing. Plus, our many years of experience designing high power supplies gives you a kit that lasts and lasts. Our latest is our greatest: check it out.

TERMS: Add 50¢ to orders under $10. Please allow 5% for shipping; any excess refunded. Street address MUST be included for COD orders. Place BankAmericard® and Mastercharge® orders ($15 minimum) by calling (415) 562-0636, 24 hours. California residents please add sales tax.

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G4

7400N TTL

SN7400N	.16	SN7469A	.25		
SN7401N	.16	SN7469N	.22	SN74154N	1.00
SN7402N	.21	SN7470N	.45	SN74155N	.99
SN7403N	.18	SN7472N	.39	SN74156N	.99
SN7404N	.18	SN7473N	.37	SN74157N	.99
SN7405N	.24	SN7474N	.32	SN74160N	1.25
SN7408N	.20	SN7475N	.32	SN74161N	.99
SN7407N	.29	SN7476N	.32	SN74163N	.99
SN7408N	.25	SN7479N	5.00	SN74164N	1.10
SN7409N	.25	SN7480N	.59	SN74165N	1.10
SN7410N	.20	SN7482N	.99	SN74166N	1.25
SN7411N	.30	SN7483N	.70	SN74167N	5.50
SN7412N	.33	SN7485N	.89	SN74170N	2.10
SN7413N	.45	SN7486N	.39	SN74173N	0.95
SN7414N	.79	SN7489N	2.10	SN74173N	1.50
SN7416N	.35	SN7488N	2.40	SN74174N	1.25
SN7417N	.35	SN7490N	.45	SN74175N	.99
SN7420N	.21	SN7491N	.75	SN74176N	.99
SN7421N	.33	SN7492N	.49	SN74177N	.99
SN7422N	.49	SN7493N	.49	SN74180N	.99
SN7423N	.37	SN7494N	.79	SN74181N	2.40
SN7425N	.29	SN7495N	.79	SN74182N	.95
SN7426N	.29	SN7496N	.89	SN74184N	2.00
SN7427N	.37	SN7497N	4.00	SN74185N	2.20
SN7428N	.42	SN74100N	1.00	SN74186N	16.00
SN7430N	.39	SN74107N	.39	SN74187N	6.00
SN7432N	.31	SN74121N	.39	SN74188N	3.00
SN7437N	.27	SN74123N	.59	SN74189N	1.19
SN7438N	.27	SN74123N	.59	SN74191N	1.25
SN7439N	.25	SN74125N	.69	SN74192N	.99
SN7440N	.15	SN74126N	.69	SN74193N	.99
SN7441N	.89	SN74132N	1.59	SN74194N	1.35
SN7442N	.59	SN74136N	.99	SN74195N	.75
SN7443N	.75	SN74141N	1.15	SN74196N	1.25
SN7444N	.75	SN74142N	4.99	SN74197N	.75
SN7445N	.75	SN74143N	4.99	SN74198N	1.75
SN7446N	.81	SN74144N	4.50	SN74199N	1.75
SN7447N	.69	SN74145N	1.15	SN74200N	5.50
SN7448N	.79	SN74147N	2.35	SN74279N	.99
SN7450N	.26	SN74148N	2.00	SN74251N	1.70
SN7451N	.27	SN74150N	1.00	SN74284N	6.00
SN7452N	.27	SN74151N	.79	SN74285N	6.00
SN7454N	.26	SN74153N	.69	SN74367N	.75

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20% Discount for 100 Combined 7400's

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CD4001	.25			74C10N	.65
CD4002	.25	CD4035	1.85	74C20N	.65
CD4006	2.50	CD4040	2.45	74C30N	.65
CD4007	.25	CD4042	1.99	74C42N	2.15
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CD4011	.35	CD4047	2.75	74C89N	3.00
CD4012	.25	CD4049	.79	74C90N	2.00
CD4013	.47	CD4050	.79	74C107N	1.25
CD4016	.56	CD4051	2.95	74C151	2.90
CD4017	1.35	CD4053	2.95	74C154	4.00
CD4019	.55	CD4060	3.25	74C157	2.15
CD4020	1.49	CD4066	1.75	74C160	3.25
CD4022	1.35	CD4069	.49	74C161	3.25
CD4023	.25	CD4071	.45	74C163	3.00
CD4024	.69	CD4081	.45	74C164	3.25
CD4025	.25	CD4511	2.59	74C173	2.60
CD4027	.69	CD4518	2.50	74C193	2.75
CD4028	1.65	MC14585	3.00	74C195	2.75
CD4029	2.50	74C00N	.39	MC4044	4.50
CD4030	.65	74C02N	.55	MC14016	.56

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LM301CN	.35	78MG	1.75	LM1458C	.85
LM308H	1.15	LM370N	1.15	LM1496N	.95
LM309H	1.00	LM373N	3.25	LM1558V	1.85
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LM308H	1.00	LM380SCN	1.45	LM3900N	.69
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LM310CN	1.15	NE510A	6.00	MC3358N	1.95
LM311H	.99	NE531H	3.00	MC3556N	1.99
LM311N	.90	NE536T	6.00	LM7325N	.90
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LM319N	1.39	NE550BN	.79		4.95
LM320K-5	1.35	NE555V	.39	LM75493	.49
LM320K-5.2	1.35	NE560B	5.00	75451CN	.39
LM320K-12	1.35	NE561B	5.00	75452CN	.39
LM320K-15	1.35	NE562B	5.00	75453CN	.39
LM320T-5	1.75	NE565H	1.25	75454CN	.39
LM320T-5.2	1.75	NE565N	1.75	75491CN	.79
LM320T-8	1.75	NE568CN	1.25	75492CN	.89
LM320T-12	1.75	NE567N	1.65	75493CN	.69
LM320T-15	1.75	NE567V	1.50	RCA LINEAR	
LM320T-18	1.75	LM703CN	.45	CA3013	2.15
LM320T-24	1.79	LM709H	.39	CA3023	2.95
LM320K-5	9.95	LM709N	.29	CA3035	2.49
LM324N	1.40	LM710N	.79	CA3039	1.50
LM339N	1.70	LM711N	.39	CA3046	1.30
LM340K-5	1.99	LM722N	.50	CA3059	3.25
LM340K-6	1.95	LM723N	.65	CA3060	3.25
LM340K-8	1.95	LM733N	1.03	CA3080	.85
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LM340K-15	1.95	LM741CH	.35	CA3082	2.00
LM340K-18	1.95	LM741CN	.35	CA3083	1.60
LM340K-24	1.95	LM741-14N	.59	CA3085	.85
LM340T-5	1.75	LM747N	.79	CA3089	3.75
LM340T-6	1.75	LM747N	.79	CA3081	10.20
LM340T-8	1.75	LM748H	.39	CA3102	2.95
LM340T-12	1.75	LM748N	.39	CA3123	2.15
LM340T-15	1.75	LM1303N	.90	CA3130	1.39
LM340T-18	1.75	LM1304N	1.19	CA3140	1.25
LM340T-24	1.75	LM1305N	1.40	CA3080	1.75
LM350N	1.00	LM1307N	.85	RC4194	5.95
LM351CN	.60	LM1310N	2.95	RC4195	3.25

74LS00 TTL

74LS00	.29	74LS107	.49	74LS139	1.95
74LS02	.29	74LS109	.59	74LS151	1.55
74LS03	.29	74LS112	.59	74LS153	1.89
74LS04	.35	74LS113	.59	74LS157	1.55
74LS05	.35	74LS114	.59	74LS162	2.25
74LS08	.29	74LS122	.75	74LS163	2.25
74LS10	.39	74LS123	.79	74LS164	1.95
74LS13	.69	74LS125	.49	74LS175	1.95
74LS14	1.75	74LS126	.75	74LS181	3.69
74LS20	.29	74LS132	1.25	74LS190	2.85
74LS26	.39	74LS133	1.25	74LS191	2.85
74LS27	.39	74LS136	.59	74LS192	2.85
74LS28	.39	74LS138	1.69	74LS193	2.85
74LS30	.29	74LS139	.99	74LS194	1.89
74LS32	.39	74LS145	.99	74LS195	1.89
74LS40	.39	74LS147	1.25	74LS257	1.75
74LS51	.29	74LS148	1.25	74LS260	.55
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74LS73	.49	74LS153	1.89	74LS670	3.95

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MM5316	4 Digit, Alarm, 1 PPS Output	6.95
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XC209	Orange	4/$1		XC111	Yellow	4/$1	XC526	Yellow	4/$1	XC556	Yellow	4/$1	INFRA-RED LED	
XC209	Yellow	4/$1		XC111	Orange	4/$1	XC526	Orange	4/$1	XC556	Orange	4/$1	¼" x ¼" x 1/16"	
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SPECIAL * — XC556 Red 100/$8.00 — 1000/$50.00 — SPECIAL *

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DL707 — DL333

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MAN 2	5 x 7 Dot Matrix	.300	4.95	MAN 4710	Common Anode-Red	.400	1.95
MAN 3	Common Cathode	.125	3/1.00	DL701	Common Anode-red ±	.300	.99
MAN 4	Common Cathode	.187	1.95	DL704	Common Cathode	.300	.99
MAN 7	Common Anode	.300	1.25	DL707	Common Anode	.300	.99
MAN 7G	Common Anode-green	.300	1.95	MAN 4740	Common Anode-Red	.400	.99
MAN 7Y	Common Anode-yellow	.300	1.95	DL741	Common Anode	.600	1.80
MAN 52	Common Anode-green	.300	.99	DL 747	Common Anode	.600	2.25
MAN 54	Common Anode-red	.480	.99	DL 750	Common Cathode	.600	2.49
MAN 74	Common Cathode	.300	1.00	DL 338	Common Cathode	.110	.59
MAN 82	Common Anode-yellow	.280	.99	FND70	Common Cathode	.250	.75
MAN 84	Common Cathode-yellow	.300	.99	FND503	Common Cathode	.500	1.08
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- ⅛" Ht. • Common Cathode • Dip Package
- 3 to 5 volts @ 5 mils per segment
- 7 segment Monolithic • Red Display

2 Digit $ .79
3 Digit .89
4 Digit .99
5 Digit 1.19

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	1-24	25-49	50-100		1-24	25-49	50-100
8 pin	$.17	.16	.15	24 pin	$.38	.37	.36
14 pin	.20	.19	.18	28 pin	.45	.44	.43
16 pin	.22	.21	.20	36 pin	.60	.59	.58
18 pin	.39	.38	.37	40 pin	.83	.82	.81
22 pin	.37	.36	.35				

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	.25	.24	28 pin	$ .99	.90	.81
16 pin	.30	.27	.25	36 pin	1.39	1.26	1.15
18 pin	.35	.32	.30	40 pin	1.59	1.45	1.30
20 pin	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

8 pin	$.30	.27	.24	24 pin	$ .79	.63	.57
14 pin	.35	.32	.29	28 pin	1.10	1.00	.90
16 pin	.38	.35	.32	36 pin	1.75	1.40	1.26
18 pin	.51	.47	.43	40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37	24 pin	$1.05	.95	.85
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16 pin	.43	.42	.41	36 pin	1.59	1.45	1.30
18 pin	.75	.68	.62	40 pin	1.75	1.55	1.40

Plastic Push Button Switch

* 18 AWG Solid Wire - 9" Long
* .09 (wide) X .09 (high) ¼-27 Thread
* 0 AMP @ 14 Volt - 1 AMP @ .10 Volt

		1-9	10-Up
J-100-1	Push On-Push Off	.59	.49
J-100-2	Normally Open	.59	.49
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JMT-221	DPDT	on/off/on	$1.95
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JMT-121	SPDT	on/off/on	$1.50
JMT-123	SPDT	on/none/on	$1.25

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use with XC556 LEDS
Specify Colors — Red - Green - Amber - Yellow

DIP SWITCHES

SPST Slide Action

- #206-4 (8 pin dip) 4 switch unit $1.75 ea.
- #206-7 (14 pin dip) 7 switch unit $1.95 ea.
- #206-8 (16 pin dip) 8 switch unit $2.25 ea.

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

		10 OHM	12 OHM	15 OHM	18 OHM	22 OHM			
ASST. 1	5 ea.	27 OHM	33 OHM	39 OHM	47 OHM	56 OHM		1/4 WATT 5% - 50 PCS.	
		68 OHM	82 OHM	100 OHM	120 OHM	150 OHM			
ASST. 2	5 ea.	180 OHM	220 OHM	270 OHM	330 OHM	390 OHM		1/4 WATT 5% - 50 PCS.	
		470 OHM	560 OHM	680 OHM	820 OHM	1K			
ASST. 3	5 ea.	1.2K	1.5K	1.8K	2.2K	2.7K		1/4 WATT 5% - 50 PCS.	
		3.3K	3.9K	4.7K	5.6K	6.8K			
ASST. 4	5 ea.	8.2K	10K	12K	15K	18K		1/4 WATT 5% - 50 PCS.	
		22K	27K	33K	39K	47K			
ASST. 5	5 ea.	56K	68K	82K	100K	120K		1/4 WATT 5% - 50 PCS.	
		150K	180K	220K	270K	330K			
ASST. 6	5 ea.	390K	470K	560K	680K	820K		1/4 WATT 5% - 50 PCS.	
		1M	1.2M	1.5M	1.8M	2.2M			
ASST. 7	5 ea.	2.7M	3.3M	3.9M	4.7M	5.6M		1/4 WATT 5% - 50 PCS.	
ASST. 8R	Includes Resistor Assortments 1-7 (350 PCS.)							**$10.95 ea.**	

$5.00 Minimum Order — U.S. Funds Only
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WIRE WRAP CENTER

HOBBY-WRAP TOOL-BW-630

- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (.025 inch)
- Complete with built-in bit and sleeve

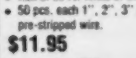
$34.95
(batteries not included)

WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP

- Tool for 30 AWG Wire
- Roll of 50 Ft. White or Blue 30 AWG Wire
- 50 pcs. each 1", 2", 3" & 4" lengths — pre-stripped wire.

$11.95



WIRE WRAP TOOL WSU-30

WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

25 ft. min. $1.25 50 ft. $1.95 100 ft. $2.95 1000 ft. $15.00
SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

CUTTER CRIMPER TOOL (CS-8)

- Plier Nose (serrated-jaw)
- Scissors Action Cutting
- 6 Bolt Cutters (4-40, 5-40, 6-32, 8-32, 10-32, 10-24)
- Crimp Stations (7mm Auto — 22-20 to 12-30 elect.)
- "Up-Front" Wire Cutting
- Scissors Action Stripping (No. 22-20 to No. 10)
- Crimp Stations — insulated (2w-20 to 12-10 elect.)

Actual Size - 8¼" length **$8.50**

Permacel Electrical Tape

- ¾" (wide) X 66 ft. (long) • All weather • Not import

$1.25 per roll — $9.95 per 10 roll package

ZENERS — DIODES — RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400mw	4/1.00	1N4685	600 PIV 1 AMP		10/1.00
1N751A	5.1	400m	4/1.00	1N4686	800 PIV 1 AMP		10/1.00
1N752	5.6	400m	4/1.00	1N4937	1000 PIV 1 AMP		10/1.00
1N753	6.2	400m	4/1.00	1N3800	50	250m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N959	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N4568	15	400m	4/1.00	1N4305	75	25m	20/1.00
1N5232	5.6	500m	2/$	1N4734	5.6	1w	$.55
1N5234	6.2	500m	3/$	1N4735	6.2	1w	.29
1N5235	6.8	500m	2/$	1N4736	6.8	1w	.29
1N5236	7.5	500m	2/$	1N4737	8.2	1w	.29
1N456	25	40m	6/1.00	1N4742	12	1w	.39
1N469	150	2w	6/1.00	1N4744	15	1w	.29
1N4454	150	10m	10/1.00	1N1183	50 PIV	35 AMP	1.60
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.90
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.80
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.00

SCR AND FW BRIDGE RECTIFIERS

C38D	15A @ 400V	SCR	$1.95
C38M	25A @ 200V	SCR	1.95
2N2338	1.8A @ 300V	SCR	.99
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

TRANSISTORS

MPS A05	5/$1.00		PN2907	3/$1.00		PN2222	4/$1.00
MPS A06	5/$1.00		PN2907A	3/$1.00		PN4250	4/$1.00
2N2219A	3/$1.00		PN3568	4/$1.00		2N4401	4/$1.00
2N2221	4/$1.00		PN3569	4/$1.00		2N4402	4/$1.00
2N2222A	5/$1.00		2N3704	5/$1.00		2N4403	4/$1.00
2N2369A	4/$1.00		2N3705	5/$1.00		2N4409	5/$1.00
2N2369A	4/$1.00		2N3706	5/$1.00		2N5086	4/$1.00
2N2484	4/$1.00		2N3707	5/$1.00		2N5087	4/$1.00
2N2906A	4/$1.00		2N3711	5/$1.00		2N5088	4/$1.00
2N2907A	5/$1.00		2N3725	$ .69		2N5089	4/$1.00
2N2923	5/$1.00		2N3725	$1.69		2N5129	5/$1.00
2N2924	2/$1.00		2N3903	5/$1.00		2N5130	5/$1.00
2N3055	$ .69		2N3904	4/$1.00		2N5139	5/$1.00
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MJE2955	$1.25		2N3906	4/$1.00		2N5551	5/$1.00
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50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100		1-9	10-49	50-100
10 pf	.05	.04	.03	.001µF	.05	.04	.035
22 pf	.05	.04	.03	.0047µF	.05	.04	.035
47 pf	.05	.04	.03	.01µF	.05	.04	.035
100 pf	.05	.04	.03	.022µF	.06	.05	.04
220 pf	.05	.04	.03	.047µF	.07	.06	.05
470 pf	.05	.04	.035	.1µF	.12	.09	.075

100 VOLT MYLAR FILM CAPACITORS

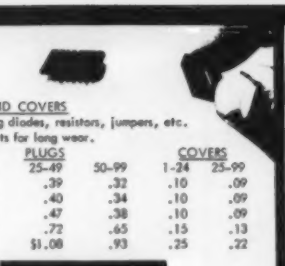
.001mf	.12	.10	.07	.022mf	.13	.11	.09
.0022	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.37	.33	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (SOLID) CAPACITORS

Radial Lead				Radial Lead			
.1/35V	.28	.23	.17	1.5/35V	.28	.25	.21
.15/35V	.28	.23	.17	2.2/25V	.31	.27	.22
.22/35V	.28	.23	.17	3.3/25V	.31	.27	.22
.33/35V	.28	.23	.17	4.7/25V	.32	.28	.23
.47/35V	.28	.23	.17	6.8/25V	.36	.31	.25
.68/35V	.28	.23	.17	10/25V	.48	.35	.29
1.0/35V	.28	.23	.17	15/25V	.63	.39	.40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

Radial Lead				Radial Lead			
47/50V	.15	.13	.10	47/25V	.15	.13	.10
1.0/50V	.16	.14	.11	47/50V	.16	.14	.11
3.3/35V	.15	.13	.10	1.0/50V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/25V	.15	.13	.10	1.0/35V	.16	.14	.11
10/50V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.16	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/35V	.25	.21	.16	10/25V	.15	.13	.10
100/25V	.24	.20	.16	10/50V	.16	.14	.12
100/50V	.35	.30	.26	47/50V	.24	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.36	100/25V	.24	.20	.18
470/25V	.33	.29	.27	100/50V	.35	.30	.26
1000/16V	.55	.50	.45	220/16V	.23	.17	.16
2200/16V	.70	.62	.55	470/25V	.31	.26	.25



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Use for mounting diodes, resistors, jumpers, etc.
Gold plated parts for long wear.

	PLUGS			COVERS	
	1-24	25-49	50-99	1-24	25-99
8 pin	.46	.39	.32	.10	.09
14 pin	.48	.40	.34	.10	.09
16 pin	.56	.47	.38	.10	.09
24 pin	.79	.72	.65	.15	.13
40 pin	$1.23	$1.08	.93	.25	.22

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Ideal for use from board to board, remote switches, in test equipment, lamp panels, etc. Made from gold plated connectors, color coded ribbon cable, molded plugs.
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To order, make up part number from characteristic and find price in chart. For instance: S-14P-18 is single ended 14 pin interconnect 18 inches in length. Price is $1.72. D-24P-06 is double ended 24 pin, 6 inches in length. Price is $4.55. Quantity pricing is available.

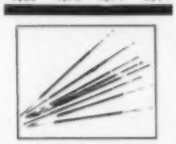
PRICE CHARTS

SINGLE END

No. Of Pins	Length 6"	12"	18"	24"	36"	48"
14P ·····	1.51	1.62	1.72	1.83	2.05	2.26
16P ·····	1.64	1.76	1.87	1.99	2.21	2.44
24P ·····	2.49	2.69	2.88	3.08	3.48	3.87

DOUBLE END

14P ·····	2.76	2.87	2.97	3.08	3.30	3.51
16P ·····	3.01	3.13	3.24	3.36	3.58	3.81
24P ·····	4.55	4.75	4.94	5.14	5.54	5.93



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14 pin 38¢ ea, 10 for $3.60 16 pin 42¢ ea, 10 for $3.90

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Features:
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.CMOS compatability (5V)
.Shifted character compatability
.Includes Greek alphabet
.Maximum access time =500nS
(See article in March '77 issue of 73 Magazine for applications including TV-Computer interface)
MCM6571A..... $9.95
Specs..... $1.00

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Generate all the sync pulses necessary for camera or video terminals. Use with MCM6571A in the TV-Computer interface. MM5320N.....$18.80
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- Two Voltage Ranges: 1.999 V and 199.9 mV
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- Z_{in} > 1000 M ohm
- Auto-Polarity and Auto-Zero
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Single chip combines linear and CMOS digital to bring you the simplest yet DVM approach. Requiring only 4 external passive parts, this subsystem gives you: Auto polarity, auto zero, single voltage reference, 8 mW operation, overrange, underrange signals, 25 conversions per second and .05% ± 1 count accuracy! 100 uV resolution. 24 Pin DIP.
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2 Amp 1000 volt rectifier	10 for 1.00
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2N3866 1W 400 MHz	1.15
2N5589 3W 175 MHz	4.75
2N5590 10W 175 MHz	7.80
2N5591 25W 175 MHz	10.95
2SC517	3.95
2SC1226	1.25
2N6080 4W 175 MHz	5.40
2N6081 15W 175 MHz	8.45
2N6082 25W 175 MHz	10.95
2N6083 30W 175 MHz	12.30
2N6084 40W 175 MHz	16.30
2SC1306	4.30
2SC1307	5.25
2N2876	special 10.95

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1N34-1N60-1N64	10 for .99
CA 3028 Dif. Amp	1.50
4060 CMOS	2.00
LM309K Volt Reg	1.10
MJ3055	2.20
5313 Clock Chip	3.95
5314 Clock Chip	4.50
5316 Clock Chip	4.95
2N6103	.89
LM309 or 741 Min DIP Op Amp	.45
LM741CE T05 Op Amp	.45
14 or 16 Pin IC Sockets	.30

.001 Pacer Cap. 192P10292 200 WVDC	.18
12.8 kHz Crystal in TO 5 Can	4.95
Slide Pots Tapered 1 K or 15 K	$ .50
Egg Insulators	.45

2N918	.95
2N2218	.45
2N2219A	.40
2N2222A	.30
2N2369	.20
2N2483	.34
2N2484	.45
2N2905	.35
2N2907	.25
2N2926G	.24
2N2926Y	.24
2N3053	.50
2N3390	.75
2N3439	1.59
2N3440	.60
2N3512	1.15
2N3553	1.40
2N3565	.22
2N3584	.30
2N3638A	.37
2N3646	.27
2N3713	1.35
2N3725A	1.80
2N3771	2.50

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Kits, Books, Boards, Magazines Special 2102LI 8 for $17.50. 8080A CPU Chip $29.95. We stock OK Battery Operated Wire Tool $34.95, OK Hand Wire Wrapped Tool $5.95. 7400 ICs CMOS, Timers PLL's IC Sockets. All kinds of transistors, rectifiers and diodes. Plus other electronic parts.

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2N3773	4.95
2N3859	.29
2N3903	.20
2N3905	.25
2N3924	1.80
2N3926	6.30
2N4041	7.80
2N4249	.25
2N4401	.25
2N4402	.25
2N4403	.25
2N4409	.19
2N4427	1.35
2N4429	7.65
2N4888	.50
2N5016	17.60
2N5090	7.50
2N5129	.40
2N5179	.90
2N5641	5.40
2N5642	10.25
2N5643	14.35
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Build the W7BBX Programmable Keyer (Ham Radio April 1976) We can supply the four PC boards and a Comprehensive Construction Manual all for only $29.95

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We have Wire Wrap Sockets and Wire Wrap Wire – 50 feet $1.98.

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STOPWATCH HAND CASE for above 3.95

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SIX DIGIT AUTO OR BOAT DIGITAL CLOCK KIT Has a beautiful Charcoal Grey moulded high temperature plastic case with chrome rim. Dimensions are 1¾" high x 4" wide x 4½" deep.

Large 0.4 LEDs display hours, minutes and seconds. Works on 12 Volt AC or DC as well as automatic switching to a 9 Volt battery for power failures. Battery (not supplied) fits in case. Provision for blanking display LEDs for out of car or boat use. Adjustable Crystal Time Base included, as well as Mobile Mounting Bracket.

KIT ONLY	$29.95
Three or more kits	27.95
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NOW NEW IMPROVED DIGITAL ALARM CLOCK KIT Hours • Minutes • Seconds displayed on six BIG 0.5 Fairchild 7 Segment Display LEDS 12-hour format 24-hour alarm with snooze feature, plus elasped time indicator and freeze feature. Eight pages of pictorials and instructions. NEW on-board power transformer and circuitry for optional time base $19.99

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A2

S.D. SALES CO.

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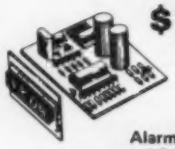
JUMBO LED CAR CLOCK



$16.95

KIT

Alarm Option – $1.50
AC XFMR – $1.50

THE HOTTEST SELLING KIT WE EVER PRODUCED!

You requested it! Our first D.C. operated clock kit. Professionally engineered from scratch. Not a makeshift kluge as sold by others.

Features:

A. Bowmar Jumbo –.5 inch LED array.
B. MOSTEK – 50250 – Super Clock Chip.
C. On board precision crystal time base.
D. 12 or 24 Hr. Real Time Format.
E. Perfect for cars, boats, vans, etc.
F. P.C. Board and all parts (less case) included.

50,000 SATISFIED CLOCK KIT CUSTOMERS CANNOT BE WRONG!

THIS MONTH'S SPECIALS

AMD – 8080A	$14.95
Z-80 CPU	49.95
82S129 1K PROM	2.50

1702A 2K EPROM

We tell it like it is. We could have said these were factory new, but here is the straight scoop. We bought a load of new computer gear that contained a quantity of 1702 A's in sockets. We carefully removed the parts, verified their quality, and are offering them on one heck of a deal. First come, first served. Satisfaction guaranteed! U.V. Eraseable. NEW PRICE! $2.95 ea.

(2.3 US access time)

UP YOUR COMPUTER!

21L02-1 1K LOW POWER 500 NS STATIC RAM Time is of the essence!

And so is power. Not only are our RAM's faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02–1 low power and super fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off.

8 for $12.95

60 HZ CRYSTAL TIME BASE

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$5.95 ea. 2/$10.00

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS clock chips.
C. Super low power consumption (1.5 MA typ.)
D. Uses latest MOS 17 stage divider IC.
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small size; can be used in existing enclosures.

Kit includes Crystal, Driver IC, PC board, plus all necessary parts and specs. At last count – over 20,000 sold!

S.D. SALES EXCLUSIVE

$12.95 MOS 6 DIGIT UP–DOWN COUNTER $12.95

40 PIN DIP. Everything you ever wanted in a counter chip. Features: Direct LED segment drive, single power supply (12 VDC TYPE.), six decades up/down, pre-loadable counter, separate pre-loadable compare register with compare output, BCD and seven segment outputs, internal scan oscillator, CMOS compatible, leading zero blanking, 1MHZ. count input frequency. Very limited quantity! WITH DATA SHEET

7400–19c	7411–29c	7451–19c	7490–65c	74153–75c
74LS00–49c	7413–50c	7453–19c	74LS90–95c	74154-1.00
7402–19c	7416–69c	7473–39c	7492–75c	74157–75c
74LS02–49c	7420–19c	7474–35c	7493–69c	74161–95c
7404–19c	7430–19c	74LS74-59c	7495–75c	74164-1.10
74L04-29c	7432–34c	7475–69c	7496–89c	74165-1.10
74S04–44c	7437–39c	7476–35c	74121-38c	74174–95c
74LS04-49c	7438–39c	7480–49c	74123-65c	74181-2.50
7406–29c	7440–19c	7483–95c	74132-1.70	74191-1.25
7408–19c	7447–85c	7485–95c	74S138-1.95	74192-1.25
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Rated 35 WVDC Upright style with PC leads. Most popular value for hobbyists. Compare at up to $1.19 ea. from franchise type electronic parts stores. S.D. Special 4/$1.

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Our best seller. Includes miniature and standard sizes; single and multi-position units. All new, first name brand. Try one package and you'll reorder more! Special 12/$1.00

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¼W 5% & 10% PC leads. A good mix of values. 200/$2.

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1N4148/1N914 100/$2.00
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Full Wave Bridge
25 AMP 50 PIV
$1.25

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PC leads. At least 10 different values. Includes .001, .01, .05, plus other standard values. 60/$1.00

$9.95 KIT

P.C. Board – 3.00
AC XFMR – 1.50

Do not confuse with Non-Alarm kits sold by our competition! Eliminate the hassle – avoid the 5314!

SIX DIGIT ALARM CLOCK KIT

We made a fantastic kit even better. Redesigned to take advantage of the latest advances in I.C. clock technology. Features: Litronix Dual ½" displays, Mostek 50250 super clock chip, single I.C. segment driver, SCR digit drivers. Greatly simplified construction. More reliable and easier to build. Kit includes all necessary parts (except case). P.C.B. or XFMR optional.

NEW! WITH JUMBO LED READOUTS!

Motorola SCR

2N4443. 8 AMP 400 PIV. P.C. Leads 3/$1.

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4W. Audio power Amp. Just out! In special heat sink DIP. One super audio IC. $1.50 with data

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.4 IN. Common Cathode. High effeciency. Has FND-70 PIN OUT. 79c

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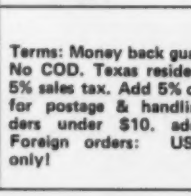

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- Dot memory.
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- Built-in side-tone monitor.
- Speed, Volume, tone & weight controls.
- Grid-block or direct keying.
- Use with external paddle such as HK-1.

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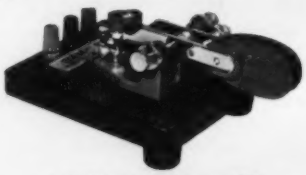
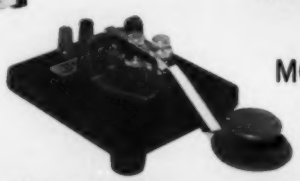
ELECTRONIC KEYER
$69.95



MODEL HK-1
$29.95



MODEL HK-3
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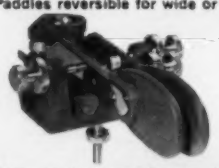
- Dual lever squeeze paddle.
- Use with HK-5 or any electronic keyer.
- Heavy base with non-slip rubber feet.
- Paddles reversible for wide or close finger spacing.

- Deluxe straight key.
- Heavy base, no need to attach to desk.
- Velvet smooth action.



MODEL HK-2
$19.95

MODEL HK-4
$44.95

- Same as HK-1, less base for those who wish to incorporate in their own Keyer.

- Combination HK-1 & HK-3 on same base.

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1N914	100v	10mA	.05
1N4004	400v	1A	.08
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	1.25
24-pin	pcb	.35	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

Molex pins	.01	To-3 Sockets	.25
2 Amp Bridge		100-prv	1.20
25 Amp Bridge		200-prv	1.95

TRANSISTORS, LEDS, etc.

2N2222	NPN			.15
2N2907	PNP			.15
2N3740	PNP	1A	60v	.25
2N3906	PNP			.10
2N3054	NPN			.35
2N3055	NPN	15A	60v	.50
T1P125	PNP	Darlington		.35

LED Green, Red, Clear	.15
D.L.747 7 seg 5/8" high com-anode	1.95
XAN72 7 seg com-anode	1.50
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4000	.15
4001	.20
4002	.20
4004	3.95
4006	1.20
4007	.35
4008	1.20
4009	.30
4010	.45
4011	.20
4012	.20
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	.95
4023	.25
4024	.75
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.35
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4041	.69
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.60
4066	1.35
4069	.40
4071	.35
4082	.45

— T T L —

7400	.15
7401	.15
7402	.20
7403	.20
7404	.15
7405	.25
7406	.35
7407	.55
7408	.25
7409	.15
7410	.10
7411	.25
7412	.30
7413	.45
7414	1.10
7416	.25
7417	.40
7420	.15
7426	.30
7427	.45
7430	.15
7432	.30
7437	.35
7438	.35
7440	.25
7441	1.15
7442	.55
7443	.85
7444	.45
7445	.80
7446	.95
7447	.95
7448	.95
7450	.25
7451	.25
7453	.20
7454	.25
7460	.40
7470	.45
7472	.45

7473	.25
7474	.35
7475	.35
7476	.30
7480	.55
7481	.75
7483	.95
7485	.95
7486	.30
7489	1.35
7490	.55
7491	.95
7492	.95
7493	.40
7494	1.25
7495	.60
7496	.80
74100	1.85
74107	.35
74121	.35
74122	.55
74123	.55
74125	.45
74126	.35
74132	1.35
74141	1.00
74150	1.00
74151	.75
74153	.95
74154	.75
74156	1.15
74157	.65
74161	.85
74163	.95
74164	.60
74165	1.50
74166	1.35
74175	.80

74176	1.25
74180	.85
74181	2.75
74182	.95
74190	1.75
74191	.35
74192	1.65
74193	.85
74194	1.25
74195	.95
74196	1.25
74197	1.25
74198	2.35
74221	1.00
74367	.85
75108A	.35
75110	.35
75491	.50
75492	.50
74H00	.25
74H01	.25
74H04	.25
74H05	.25
74H08	.35
74H10	.35
74H11	.25
74H15	.30
74H20	.30
74H21	.25
74H22	.40
74H30	.25
74H40	.25
74H50	.25
74H51	.25
74H52	.15
74H53J	.25
74H55	.25

74H72	.55
74H101	.75
74H103	.75
74H106	.95
74L00	.35
74L02	.35
74L03	.30
74L04	.35
74L10	.35
74L20	.35
74L30	.45
74L47	1.95
74L51	.45
74L55	.65
74L72	.45
74L73	.40
74L74	.45
74L75	.55
74L93	.55
74L123	.55
74S00	.55
74S02	.55
74S03	.40
74S04	.35
74S05	.35
74S08	.35
74S10	.35
74S11	.35
74S20	.35
74S40	.25
74S50	.25
74S51	.45
74S64	.25
74S74	.40
74S112	.90
74S114	1.30

74S133	.45
74S140	.75
74S151	.35
74S153	.35
74S157	.80
74S158	.35
74S194	1.05
74S257(8123)	.25
74LS00	.45
74LS01	.45
74LS02	.45
74LS04	.45
74LS05	.55
74LS08	.45
74LS09	.45
74LS10	.45
74LS11	.45
74LS20	.40
74LS21	.25
74LS22	.25
74LS32	.40
74LS37	.40
74LS40	.55
74LS42	1.75
74LS51	.65
74LS74	.75
74LS86	.75
74LS90	1.30
74LS93	1.00
74LS107	.95
74LS123	1.00
74LS151	.75
74LS153	1.20
74LS157	.85
74LS164	1.90
74LS367	.85
74LS368	.70

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9309	.35
9322	.85
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74S188 (8223)	3.00
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MM5314	3.00
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2102L-1	1.95
TMS6011NC	6.95
8080AD	15.00
8T13	1.50
8T23	1.50
8T24	2.00
2107B-4	4.95

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LM309K(340K-5)	.85
LM310	1.15
LM311D(Mini)	.75
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LM320K5	1.65
LM320K12	1.65
LM320T12	1.25
LM320T15	1.65
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LM340T-12	1.00
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LM340T-18	1.00
LM340T-24	.95
LM340K-12	2.15
LM340K-15	1.25
LM340K-18	1.25
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LM711	.45
LM723	.45
LM725	1.75
LM739	1.50
LM741 8-14	.20
LM747	1.10
LM1307	1.25
LM1458	.95
LM3900	.50
LM75451	.65
NE555	.50
NE556	.95
NE565	.95
NE566	1.75
NE567	1.35
SN72720	1.35
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$1.98
Distributor unloads barrels of assrtd bulbs, pop'l'r voltages to 24V. Screw & bayonet. Wt. 4 ozs. No. GA3581

BARREL KIT #211 LO-PROFILE TO-5's
50 for $1.98
NPN power transistors, mostly good. Bvceo 40V, Ic 2A, hfe 30-100. Up to 250 MHZ. Like RCA 2N6189. Wt. 12 oz. No. GA3581

BARREL KIT #216 A / GLOWIN' PANELS
3 for $1.98
4" x 1" panels that glow blue-green with 110VAC. Use for site lites, indicators, etc. Cat. No. GA3810

BARREL KIT #205 MINI BLOCK CAPACITORS
50 for $1.98
Unbelievable! Worth $50. High precision submini caps for all applications. Wt. 3 ozs. Cat. No. GA1826

BARREL KIT #203 CALCULATOR KEYBOARDS
10 for $1.98
It's true! 30-key, 4 function keyboards at ridiculous give-away. Wt. 12 ozs. Cat. No. GA3625

100 for $1.98 KIT #202 PLUGS, SOCKETS
Distributor unloads! Includes AC, DC, RF, audio, 4-8 pin, all kinds. Wt. 1 lb. Cat No. GA3527

BARREL KIT #201 6V INDICATORS w/leads
15 for $1.98
Test lamp manufacturer dumps inventory! Worth 69¢ ea. Like go-n-o-wheat. Cat. No. GA3526

BARREL KIT #206 9 DIGIT READOUT MODULES
5 for $1.98
with calculator driver chips beneath epoxy & PNPs. Cat. No. GA3818

BARREL KIT #198 TRANSISTORS & DARLINGTONS
50 for $1.98
Motorola dumps 1,000,000 TO-220 to barrels. NPN's & PNPs. Cat. No. GA3823

BARREL KIT #194 10-AMP INLINE BRIDGE RECTIFIERS
20 for $1.98
Assrtd voltage. We can't test 'em, No. GA3475

BARREL KIT #193 NYLON GEARS
40 for $1.98
Wide variety of sizes 1" to 3" gears for the mechanical gear train hobbyists. Wt. 10 ozs. No. GA3427

BARREL KIT #191 CARBOFILM RESISTORS
800* for $1.98
*½ pound, approx. ⅛, ¼ watters. Assrt. values. Unmarked, Cat. No. GA3445

BARREL KIT #188 400 Parts $1.98
Includes resistors, caps, transformers, rectifiers, diodes, etc. for p.c. work. Preformed, dumped into barrels by factorius. 100% . Cat. No. GA 3491

BARREL KIT #186 KEYBOARD CHIPS
10 for $1.98
Truthfully we don't know what 'em, MM6740's, keyboard encoder chips. No. GA3414

BARREL KIT #184 ¼-WATT METAL FILM
150 for $1.98
100% metal film resistors. Long leads. GA3413

BARREL KIT #182 JUMBO RED LEDS
15 for $1.98
100% material, user cancellation from factory dumps, 3V 10 mils. For 1000's of projects, red lens. Cat. No. GA3369

BARREL KIT #181 MICRO ZENERS
100 for $1.98
1-Watt, tiny, 100% material, from 2V to 30V. Axial leads. No shorts, no opens. DO-7 & micro epoxy units. Cat. No. GA3368

BARREL KIT #183 MINI TRIM POTS
30 for 1 oz. $1.98
Assrt. values 100 to 1 meg. What a buy. Single turn, ⅛ W, Wt. 6 oz. GA3348

BARREL KIT #191 "POP" PLASTIC TRANSISTORS
25 for $1.98
2N3904's with some 2N3906's of 100% material. TO-92. Preformed. Cat. No. GA3343 1 oz.

BARREL KIT #180 V. REGULATORS
10 for $1.98
No. GA3230
LM309KC TO-3 V.R.'s barreled. Bot by the pound.

BARREL KIT #189 MODULAR SWITCHES
25 for $1.98
Centralab switches. TV-makers excess. Dpdt, 6pdt, etc. Brand new. Cat. No. GA 3160

BARREL KIT #188 MAGNIFIED MAN-3's
20 for $1.98
MAN-3, 7, seg readout, with built-on magnifier. Factory discontinued line, 100% material. Cat. No. GA3328 1 oz.

BARREL KIT #184 CLOCK CHIPS
20 for $1.98
We gathered an assortment of clock chip, alarm, calendar, beepers, who knows, all mixed. Cat. No. GA 3302

BARREL KIT #149 ROCKER SWITCHES
12 for $1.98
No. GA 3302

BARREL KIT #148 MINI TRANSFORMER
15 for $1.98
outputs, interstage and audio. Only 1" sq. Wt. 2 lbs. GA 3294

BARREL KIT #144 RCA PHONO PLUGS
40 for $1.98
1,000,000 RCA phono plugs per this one. You hi-fi-ers know wut they are . . . 100% material. GA 3293

BARREL KIT #138 PANEL SWITCHES
30 for $1.98
Did you hear of OAK? Another supp maker barrelled all types of rotaries, electric, sliders etc. GA3268

BARREL KIT #135 MICRO MINI LAMPS
20 for $1.98
Imagine! Micro size (⅛ x ¼") with wire leads. 3 to 5 VDC, 40 mils. GA3289

BARREL KIT #129 MINI DIP ICS
100 for $1.98
Large mfgr dumped 100's of the into barrels. Includes 741s, LM-380-8, 703, 567, 555, 556—but who knows? Wt 1 lb. GA 3248

BARREL KIT #127 AXIAL ELECTROS
40 for $1.98
Assrt. capacities and voltages. Cat. No. GA 3227

BARREL KIT #126 UPRIGHT ELECTROS
40 for $1.98
1mf to 300mf in mixture of voltages. 100% marked 'n good. GA3226

BARREL KIT #118 MOLEX SOCKETS
100 good
200 for $1.98 Cat. No. GA3144
Calculator maker dumps! We got a zillion of 'em.

BARREL KIT #112 MICRO MINI LEDS
40 for $1.98
All the tiny leds, axial, upright of Monsanto, Litronix, variety of colors. Yield 80% or better. GA 71230

BARREL KIT #109 TERMINAL STRIPS
100 for $1.98
Wide assrt. of terminal strip connectors, from 1 contact up. Strip manufacturers barrel dump in your gain. Wt. 1 lb. Cat. No. GA 3126

BARREL KIT #104 SLIDE VOLUME CONTROLS
10 for $1.98
Cat. No. GA 1057

BARREL KIT #102 SILICONE GREASE
Tube
Use on heat sinks, pots, etc. Cat. No. GA 3125

BARREL KIT #101 RESISTOR SPECIAL
200 for $1.98
Includes: ⅛, ¼, ½, 1, 2-watters, carbon film etc. 100% good. Cat. No. GA3054

BARREL KIT #99 PHOTO ELECTRIC CELLS
10 for $1.98
Assrt. GE types, CDS types. Mixed by factory. Big job for us to separate. 100% good. Cat. No. GA3053

BARREL KIT #93 HALF WATTERS
200 for $1.98
Resistor factory tried to fool us by mixing 100% color-coded resistors in barrel. But value in there. 4 ozs. GA 3046. Untested

BARREL KIT #92 3 AMP EPOXY RECTIFIERS Untested
100 for $1.98
Cosmetic rejects, electrically fine business! You check 'em, it's not for us. Assrt. voltages. GA 3304

BARREL KIT #91 SILVER MICAS
100 for $1.98
Axial, red case, variety of physical sizes & values. Cat. No. GA 3018

NATIONAL IC BONANZA
100 for $1.98
Types 8000, 7400 series, DTLs, ROMs, registers, clock & calc. chips, linears, etc. Save 2/3rds! No. GA 2841

BARREL KIT #86 HOBBY LEDS
40 for $1.98 Untested
747's, 727's, singles, triples, etc. .33 to 0.6. Hot from factory, all mixed; save 2/3rds! Cat. No. GA 2959 Untested

BARREL KIT #83, 15 for $1.98 LM-340T VOLT REG
Factory rejected them for length of leads. May include 5, 6, 8, 12, 15, 18, 24 volts. Power tab. Cat. No. GA 2938

BARREL KIT #81 SUBMINI RESISTORS
200 for $1.98
PC, upright type, color coded, ⅛ watt. Assrt values. Come to us in a barrel. Cat. No. GA 2746 100% good

BARREL KIT #76 1-WATT ZENERS
100 for $1.98
Factory same as 400-mw's. Never-to-see-again offer. 6, 8, 10, 12, 15V. under glass. Double plug. Cat. No. GA 2741 Untested.

BARREL KIT #73 TRANSISTOR ELECTROS
50 for $1.98
We don't wish to separate wide assrt voltages & values up to 300 mf. Cat. GA 2747

BARREL KIT #71 CAPACITOR SPECIAL
100 pcs. $1.98
micas, moldeds, plastics, ceramics, discs, etc. Nifty 100% good Cat. No. GA 2739

BARREL KIT #68 3 WATTERS
100 for $1.98 100% good.
Suppliers throw 'em in the barrel. It's a H'l gold mine. All marked. Cat. No. GA 2734

BARREL KIT #65 MIXED READOUTS
10 for $1.98
Factory returns — such numbers as MAN-4's, MAN-7's, MAN-3's, 11 barrels & no time to separate. Cat. No. GA 2723 Untested.

BARREL KIT #61 POLYSTYRENE CAPS
100 for $1.98
Finest caps made. As a gamble we bought 10 barrels from factory, mixed values; all good. Cat. No. GA 2729

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☐ SN7404N	.16	.17
☐ SN7405N	.18	.19
☐ SN7406N	.35	.36
☐ SN7407N	.35	.36
☐ SN7409N	.18	.19
☐ SN7410N	.16	.17
☐ SN7411N	.35	.36
☐ SN7413N	.45	.46
☐ SN7417N	.35	.36
☐ SN74260N	.16	.17
☐ SN7421N	.29	.30
☐ SN7423N	.35	.36
☐ SN7430N	.37	.38
☐ SN7437N	.16	.17
☐ SN7438N	.26	.27
☐ SN7440N	.16	.17
☐ SN7441N	.84	.88
☐ SN7442N	.52	.54
☐ SN7443N	.69	.70
☐ SN7444N	.79	.80
☐ SN7447N	.79	.80
☐ SN7448N	.76	.77
☐ SN7450N	.16	.17
☐ SN7451N	.16	.17
☐ SN7453N	.16	.17
☐ SN7464N	.16	.17
☐ SN7470N	.45	.46
☐ SN7472N	.36	.37
☐ SN7473N	.36	.37
☐ SN7474N	.31	.32
☐ SN7476N	.31	.32
☐ SN7480N	.69	.70
☐ SN7482N	.69	.70
☐ SN7489N	1.49	1.50
☐ SN7490N	.44	.45
☐ SN7491N	.73	.74
☐ SN7492N	.47	.48
☐ SN7493N	.47	.48
☐ SN7494N	.78	.79
☐ SN7495N	.78	.79
☐ SN7496N	.72	.73

SALE — Back By Popular Demand!

☐ SN74100N	.99	.99
☐ SN74106N	.69	.69
☐ SN74107N	.33	.34
☐ SN74109N	.33	.34
☐ SN74113N	.65	.66
☐ SN74114N	.65	.66
☐ SN74123N	.99	1.00
☐ SN74132N	.99	.99
☐ SN74136N	.99	.99
☐ SN74138N	1.00	1.01
☐ SN74139N	1.00	1.01
☐ SN74141N	.99	.99
☐ SN74148N	.99	.70
☐ SN74150N	1.39	1.40
☐ SN74180N	.99	1.00
☐ SN74181N	.70	.71
☐ SN74182N	.69	.69
☐ SN74184N	1.03	1.04
☐ SN74185N	.70	.71
☐ SN74187N	.70	.71
☐ SN74188N	.85	.86
☐ SN74189N	.85	.86
☐ SN74191N	.99	.99
☐ SN74192N	.99	.99
☐ SN74193N	.99	1.00
☐ SN74173N	1.39	1.40
☐ SN74174N	.87	.88
☐ SN74175N	.89	.90
☐ SN74176N	.79	.80
☐ SN74177N	.79	.80
☐ SN74181N	2.05	2.06
☐ SN74184N	1.75	1.76
☐ SN74185N	1.75	1.76
☐ SN74190N	1.15	1.16
☐ SN74191N	1.05	1.06
☐ SN74192N	.87	.88
☐ SN74193N	.83	.84
☐ SN74195N	.73	.74
☐ SN74196N	.82	.82
☐ SN74197N	1.49	1.50
☐ SN74199N	1.49	1.50
☐ SN74200N	3.98	3.98
☐ SN74221N	1.98	1.98
☐ SN74284N	5.95	5.95
☐ SN74285N	5.95	5.95

BARREL KIT #37 1 AMP "BULLETT" RECTIFIERS Untested
100 for $1.98
Famous style, assrtd. voltages, silicon, axial includes all types and voltages to 1KV. Cat. No. GA 2615

BARREL KIT #36 GERMANIUM DIODES Untested
200 for $1.98
Cat. No. GA 2614
Famous, mostly popular item. Never grows old.

BARREL KIT #35 NEON LAMPS
30 for $1.98 100% good.
Famous NE-2's. All prime, but factory made millions and barrel'ed 'em. Your assortment! Cat. No. GA 2613

BARREL KIT #34 8 DIGIT READOUTS
10 for $1.98
Bargain of a lifetime! All we got was 1 barrel — the "blindor digit" types. Multiplexed. Cat. No. GA 2732

BARREL KIT #40 PNP HIGH-POWER TRANSISTORS
20 for $1.98
Popular germanium TO-3 case GA 2816 100% good

BARREL KIT #31 METALLIC RESISTORS
100 for $1.98
Made mostly by Corning, the finest resistor made. Mostly ½ watters. 1% to 5% tol. & a barrel of values. Cat. No. GA 2699

BARREL KIT #30 PREFORMED RESISTORS
200 for $1.98
We got barrels of ¼ and ½ watters for pc use. 100: ¼, 100 ½ watters. No. GA 2698 100% good

BARREL KIT #27 PREFORMED DISCS
150 for $1.98
Hi-Fi mfr's shelf inventory but he dumped 'em in barrels. Preformed, for PC use. Mixed values too! GA2700

KIT #26 PLASTIC TRANSISTORS
100 for $1.98 Untested.
Type TO-92 (TO-18), all manufacturers, variety of 2N #'s. Cat. No. GA 2604

BARREL KIT #25 METAL CAN TRANSISTORS
100 for $1.98
Includes TO-5, TO-1, TO-18, etc., assorted 2N numbers, unmarked etc. Cat. No. GA 2603 Untested.

BARREL KIT #20 LONG LEAD DISCS
100 for $1.98
"surtion sale" Prime, marked only. Long leads. Cat. No. GA 2598 100% good

BARREL KIT #19 DIPPED MYLARS
60 for $1.98
Finest capacitors made, shiny finish. Imagine factory dumping 'em in barrels. Cat. No. GA 2587 100% good

BARREL KIT #17 LINEAR & 7400 DIPS
100 for $1.98 Untested
Marked and unmarked, interest numbers of raw factory stock. Cat. No. GA 2431

BARREL KIT #15 MOSFET TRANSISTORS
60 for $1.98
All 4 leaders TO-18 case, includes UHF transistors too! Cat. No. GA 2429

BARREL KIT #14 PRECISION RESISTORS
200 for $1.98
Marked and unmarked ¼, ½, 2 watts. No. GA 2628

BARREL KIT #11 POWER TAB TRANSISTORS
40 for $1.98
NPN, plastic TO220 type. Assorted 2N numbers. No. GA 2425 Untested.

BARREL KIT #10 ROMS-REGISTERS
75 for $1.98
Untested
24 to 40 pin devices, marked, internal factory numbers, etc Cat. No. GA 2424

BARREL KIT #8 SUBMINIATURE IF TRANSFORMERS
75 for $1.98
Amazing, includes 455khz, 10.7mhz, who knows! Cat. No. GA2423 100% good

BARREL KIT #7 VOLUME CONTROL
30 for $1.98
100% good
Singles, duals, variety of values, styles, big ones — small ones. Cat. No. GA 2421

BARREL KIT #5 SCRS, TRIACS, QUADRACS
40 for $1.98
Raw factory stock! All the 10 amp types. Cat. No. GA 2419 Untested.

BARREL KIT #4 "4000" RECTIFIERS
100 for $1.98 Untested.
1N4000 series. May include 25, 50, 100, 200, 400, 600, 800 and 1000 volters. GA2417

BARREL KIT # 3 1N4148/914 SWITCHING DIODES
100 for $1.98
Imagine famous switching diodes at these prices! Cat. No. GA2418 Untested.

BARREL KIT #2 LINEAR OP AMPS, DIPS 75 for Untested $1.98
May include 709's, 741's, 703's, 560 series, 555 includes GA2416

BARREL KIT #1 SN7400 DIP IC'S.
75 for $1.98
Marked 14 and/or with 16 pin dips, may include gates, registers, flip flops, counters. GA 2415 Untest

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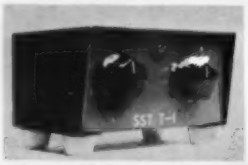

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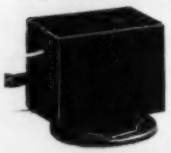

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Social Events

SCARBOROUGH, ONTARIO
JUNE 3-5

The Scarborough Amateur Radio Club invites you to the ARRL 1977 National Convention held on June 3-5, 1977 at the Sheraton Centre Hotel. There will be special programs for ladies and children, exhibition of world's leading ham equipment, contests, awards, Q.C.W.A. luncheon, royal order of the Wouff Hong, microprocessor forums, outstanding speakers and forums, and a CLARA luncheon. Saturday nite there will be a memorable dinner and dance. For further details write: '77 ARRL National Convention, P.O. Box 1011, Station "C", Scarborough, Ontario M1H 2Z4.

WENATCHEE WA
JUNE 4-5

The Apple City Amateur Radio Club of Wenatchee, Washington will sponsor the 6th Annual Central Washington Hamfest on Saturday and Sunday, June 4 and 5, 1977, at the park at Rocky Reach Dam, located 7 miles north of Wenatchee. Commercial exhibits, swap and shop tables, free trailer and tent space with electrical hookups. Banquet Saturday evening at 6 pm at the Columbia Hotel. Park will be open 2 pm Friday. Hamfest registration $3, XYL-YLs $1, banquet $3.75. Talk-in 146.07/67 WR7ADX, 146.760, 3.960. For more information write or call Apple City Amateur Radio Club, 919 N. Woodward Dr., Wenatchee WA 98801, (509) 662-8466.

ROME NY
JUNE 5

The 25th Annual Rome Ham Family Day will be held June 5, 1977 at the Beeches, Rt. 26, Rome, New York. There will be interesting programs for everyone including the XYL and children. There will be a giant flea market and 5000 square feet of air conditioned indoor display area featuring equipment displays, contests, xcvr checks, door prizes, speakers, etc. For more info write PO Box 721, Rome NY 13440.

CLEVELAND OH
JUNE 10-12

Computerest '77 will be held Friday, June 10, 4 pm to 10 pm; Saturday, June 11, 9 am to 7 pm; and Sunday, June 12, 10 am to 3 pm at the Bond Court Hotel, 777 St. Clair Avenue, Cleveland, Ohio. $2.00 per ticket. Your one ticket admits you to everything, including manufacturer's exhibits, MACC Club displays, flea market, seminars and tech sessions, and of course, prizes, games, demonstrations and good times. For more info send an SASE to Midwest Affiliation of Computer Clubs, PO Box 83, Brecksville OH 44141.

HERNANDO MS
JUNE 11-12

The Chickasaw Amateur Radio Association, Inc., "CARA," of Hernando, Mississippi presents its annual Tri-State Hamfest June 11-12, 1977 at the National Guard Armory in Hernando, Mississippi, 20 miles south of Memphis, TN on Interstate 55. Plenty of parking area with camping sites. Tables available at $2.00. Doors open 12:00 to 6:00 Saturday, June 11th, and 8:00 to 4:00 Sunday, June 12th. Prizes, food, and beverages. Talk-in on 146.31/91, 146.52, and 3987.5. For further information write CARA, PO Box 2, ATTN: R. Gates, Hernando MS 38632.

JEFFERSON CITY MO
JUNE 12

The Missouri Single Sideband Net Annual Picnic will be held June 12, 1977 beginning at 9 am in the Shelter House, Memorial Park, Jefferson City MO. Covered dish dinner, beverages furnished, lots of prizes. Donation $1.00 at the door. Talk-in 94/94. For more information contact WBØFND, Rt. 4, Box 886, Warrensburg MO 64093.

AKRON OH
JUNE 12

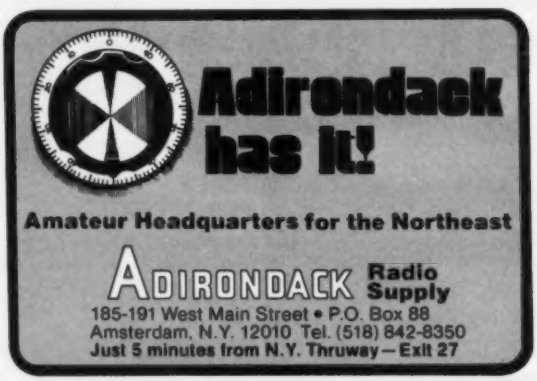
The Goodyear Amateur Radio Club of Akron, Ohio will hold its 10th Annual Hamfest and Family Picnic on June 12, 1977 at Wingfoot Lake Park between the hours of 10 am and 6 pm. The park is located southeast of Akron on County Road 87 near Route 43. Ample parking, rain shelters, picnic facilities, kids' play areas and refreshment stands. The flea market/swap shop space is free with the admission ticket. Gear displays, prizes, etc. Sorry — no overnight parking or swimming. Mobile check-in on 04/64. Family donation $2 advance, $2.50 at gate. For more info contact Don Rogers WA8SXJ, 161 S. Hawkins Ave., Akron, Ohio 44313. Phone: (216) 864-3665.

NEWBERRY MI
JUNE 12

The Tahquamenon Amateur Radio Society swap and shop will be held Sunday, June 12, 10 am to 6 pm at the Pentland Township Hall, 3 miles south of Newberry and 2 miles west on highway M-28. Refreshments at the site, ample parking, campsites available at a nominal fee. Reg. $2 at the door. Drawings and door prize. Many free family passes for tours in the famous Tahquamenon area. Many other prizes. Talk-in on 25-85, 28-88 52 & 94 simplex. Correspondence W8GBR.

ATLANTA GA
JUNE 18-19

The 49th Annual Atlanta Ham-Festival and 1977 Georgia ARRL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Convention will be held June 18 and 19, 1977 in Atlanta at the Downtown Marriott Hotel (rooms: $18 single, $24 double). This year's show includes 120 commercial booths, a 250+ car covered flea market and swapshop, more than 50 technical forums, and $6,000 worth of prizes. Advance registration is $3 individual and $5 family; at the door, $4 individual and $5 family. A preregistration package will be mailed on May 1st to all who have attended the HamFestival within the past three years; if you have not received a package by May 10th, you may write to Atlanta HamFestival, 53 Old Stone Mill Road, Marietta GA 30067 or call (404) 971-HAMS anytime day or night. Doors open at 9 am Saturday and Sunday.

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Hogwash.

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A home computer system can cost you a bundle if you don't know what you are doing. Kilobaud could save you a lot of money . . . others have learned the hard way. Kilobaud is a sort of giant club newsletter for computer hobbyists . . . a place to tell each other about the problems they've had . . . and the solutions. It's a magazine filled with great articles . . . all written so you'll be able to understand them (for a change).

You want to know about hardware? Read about the new MITS Z-80 CPU in Kilobaud, simply explained by the chap who designed the circuit. Or how about the best-selling TDL Z-80 CPU . . . the designer has written about it in Kilobaud too. You're wondering about what cassette system to use? You can go crazy on this one . . . but before flipping out, read the Hal Walker article in Kilobaud and find out what the problems are . . . and the solutions.

What do you do with the confounded things after you've gotten them working? The programs are in Kilobaud . . . lot's of them.

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Perhaps you've been thinking of the computer hobby as a way to get into a small business. Why not? This is going to be an enormous field in a couple of years and you can bet that those on the ground floor will have the best chance at the gold ring. Kilobaud will help you learn how to get into manufacturing . . . to become a dealer . . . a manufacturer's representative . . . a service bureau . . . a writer. Never before has there been an opportunity like this . . . so don't muff it . . . grab hold and start getting your feet wet. It'll not only pay off well in the long run, you'll have a ball every minute of the way.

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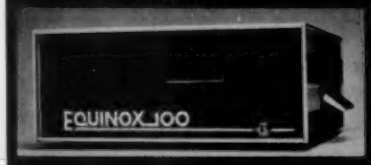

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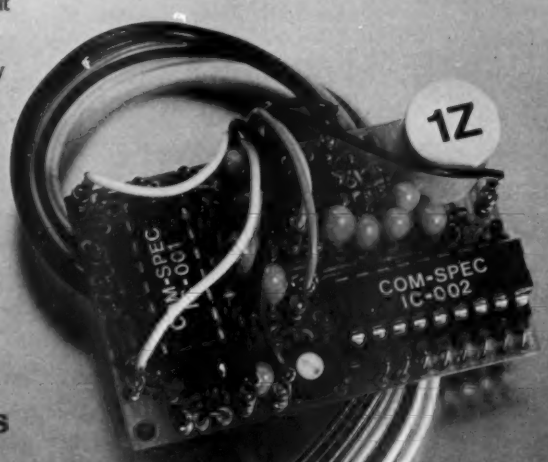

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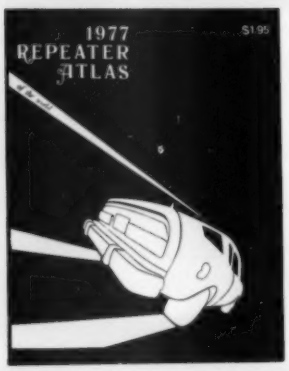

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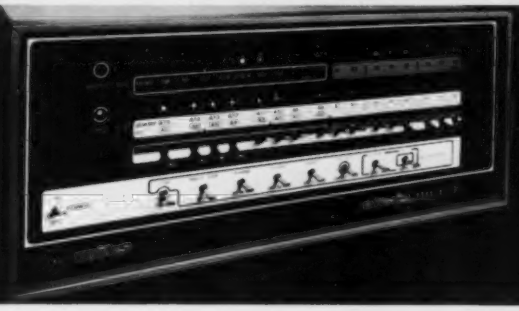

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See dozens of microcomputer systems on display and running . . . sit down and give them a try . . . find out why people get hooked on Star Trek . . . find out why 100,000 computer-maniacs have gone nuts over microcomputers. See a couple of hundred exhibits of computers, memory boards, printers, floppy disks – see it all at the Pier this August!

Hear top computerized hams explain about the fun they are having and the fun you can have. This show is worth the trip from anywhere. Charter flights are being organized from the West Coast and Japan.

See the manufacturers show and tell about their systems . . . and answer your questions – in detail. You don't have to be a computer expert to find out how exciting microcomputers are . . . and why they are going to be a multi-billion dollar business before long. One look will convince you.

See Morse code translated into print . . . even into voice . . . all by microcomputer . . . and at a price within reasonable hobby limits. See Oscar data computers . . . repeater control computers . . . all sorts of fantastic ham applications of microcomputers.

Don't miss the fun at the Pier in Boston . . . where calculators . . . TV Games . . . Microcomputers . . . Hobby computer systems . . . ham computer systems . . . and even small business computers you may be able to use in your business will be on display and running for you to try out.

See a $250 computer which will beat you at chess . . . they come in all prices, from under $100 up to the sky!

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The NEW calculators do a lot . . . even have memory . . . will play lunar landing games . . . see them at the Pier!

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The back issues of 73 are a gold mine of interesting articles . . . just take a look at what's been covered . . . every possible interest. This is the most important library you can have for hamming.

The supply of these back issues is very limited . . . and when these are gone, that will be it. Don't miss out by procrastinating.

Single issues ..... $1.50 each (before 1976)
Ten back issues (your choice) ..... $12 postpaid in US.
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Twenty-five back issues (our choice) $10 postpaid in US.

JUNE 63. Surplus issue: DMQ-2 Beacon Tx on 220, increasing ARC-2 transceiver selectivity, PE-97A pwr supply conversion, BC-348 band-spread, inductance tester, converting BC-230 tx, beginner's rx using BC-453, recvr motor-tuning, transistor cw monitor, BC-442 ant relay conversion, mobile loading coils, increasing Two-er selectivity, TV with the ART-26 tx, TRC-8 rx on 220, ARC-5 hf rx & tx, ARC-3 tx on 2M.

AUG 63. Battery-op 6M stn, diode noise gen, video modulation, magic T-R switch, ant gain, halo mods, cw breakin, VEE beam design, coax losses, RF wattmeter, TX Tube Guide, diode pwr supply, "Lunchbox" squelch, SWR explanation, vertical ant info, info on Windom ant.

OCT 63. WBFM transceiver ideas, HF propagation, cheap fone patch, remote-tuned Yagi, construction hints, ant coupler, 6S vertical, filament xformer construction, 2M nuvistor converter, Lafayette HE-35 mods, Buyer's Guide to Rx & Tx, product detector, novel Hi-C VFO, radio astronomy, panadaptor "if" converter, compact mike amp.

FEB 64. 2M multichannel exciter, rx design ideas, majic t/r switch, loudspeaker enclosures, 40M 2W tx, look at test equipment, radio grounds, 40M ZL Special ant, neutralization.

MAY 67. Quad issue: 432 Quad-quad-quad, expanded HF quad, Two el quad, miniquad, 40M quad, quad experiments, half-quad, three el quad, 20M quad, tiltover quad, easy-to-erect quad, Quad Bibliography, FET vfo, tube troubleshooting, HF dummy load, understanding "dB," HF SSB/cw rx, geometric circuit design, GSB-201 transceive, FET converter for 10-20M, hi-pass rx filters.

JULY 67. VE ham radio, VE9 hams, dsb adaptor, home brew tower, transistor design, '39 World's Fair, gnd plane ant, G4ZU beam, SSTV monitor, UHF FET preamps, IC "if" strip, vertical ant, VHF/UHF dipper, tower hints, scope monitoring, operating desk, S-Line crossband, hi-school ham club, Heath HR-10 mods.

OCT 67. HF solid state rx, rugged rotator, designing slug-tuned coils, FET converter, SSTV pix gen, VHF log-periodics, rotatable dipole, gamma-match cap, old-time dxing, modern dxing.

JUNE 68. Surplus issue: Transformer tricks, BC-1206 rx, APS-13 ATV tx, low voltage dc supply, surplus scopes, FM rig commercial xtal types, Wilcox F-3 rx, restoring old equipment, 75A1 rx mods, TRA-19 on 432, freq counter uses, transceiver pwr supply, uses for cheap tape recorders, Surplus Conversion Bibliography, RT-209 walkie on 2M, ARC-1 guard rx, RTTY tx TU.

JULY 68. Wooden tower construction, tiltover towers, erecting a telephone pole, IC AF osc, "dB" explained, ham club tips (Part 1).

SEPT 68. Mobile vhf, 432 FET preamps, converting TV Tuners, xtal osc stability, parallel-Tee design, moonbounce rhombic, 6M xciter (corrections Jan 69), 6M transceiver (corrections Jan 69), 2M dsb amp, ham club tips (Part 3).

NOV 68. SSB xtal filters, solid state trouble-shooting, IC freq counter (many errors & omissions), "cv" transformers, space comm odyssey, pulser info, thin-wire ants, 40M transistor cw tx/rx, BC-348M double conversion, multifunction tester, copper wire specs, thermistor applications, hi-voltage transistor list, ham club tips (Part 5).

JAN 69. Suppressor compressor, HW-12 on 160, beam tuning, AC voltage control, 2M transistor tx, LC power reducer, spectrum analysis info, 6M transistor rx, operating console, RTTY autostart, calculating osc stability, lo-pwr 40 cw tx, sequential relay switching, sightless operator's bridge, ham club tips (Part 7).

FEB 69. SSTV camera mod for fast-scan, tri-band linear, selective af filter, unijunction transistor info, Nikola Tesla biography, mobile installation hints, extra-class license study (Part 1).

MAR 69. Surplus issue: TCS tx mods, cheap compressor/amp, RXZ calculations, transistor keyer, better balanced modulator, transistor oscillators, using blowers, halfwave feedline info, Surplus Conversion Bibliography, extra license study (Part 2).

APR 69. 2-channel scope amp, rx preamp, Two-er PTT, variable DC load, SWR bridge, 100 kHz marker gene, some transistor specs, SB-610 monitorscope mods, portable 6M AM tx, 2M converter, extra license study (Part 3).

MAY 69. 2M Turnstile, 2M Slot, rx attenuator, generator filter, short VEE, quad tuning, using antennascope, measuring ant gain, phone patch regs, SWR indicator, 160M short verticals, 15M antenna, HF propegation angles, FSK exciter, KW summy load, hi-power linear, extra license study (part 4), all-band curtain array.

JUNE 69. Microwave pwr generation, 6M stb tx, 432-er tx/rx, 6M converter, 2M 5/8 wave whip, UHF tv tuners, ATV video modulator, UHF FET preamps, RTTY monitorscope, extra license study (part 5), building uhf cavities, mini-VEE for 10-20M, vhf vfo.

JULY 69. AM modulator, SSTV sig gen, 6M kw linear, 432 KW amp, 432-er tx/rx, 6M IC converter, radio-controlled models, RTTY IC TU, audio notch filter, VRC-19 conversion, tube substitution, 2M transistor xciter, extra license study (part 6), hf FET vfo.

AUG 69. FET regen for 3.5 MHz up, FM crystal switching, 5/8 wave vertical, introduction to ICs, RTTY tone gen, good/bad transistor checker, 2M AM tx, measure transistor Ft, 160M propegation, triac applications, simple IF sweep gen, transistor keyer, SB-100 on 6M, xtal freq measurement, extra license study (part 7), FM deviation meter, qrp am 6M tx, circular quads, FM noise figure, transistor parameter tracer.

SEPT 69. Tunnel diode theory, majic tee, soldering techniques, wave travel theory, cable shielding, transistor theory, AM noise limiter, AFSK gen, transistor amp debugging, measure meter resistance, diode-stack pwr supply, transistor testing, 2½W 6M tx, HX-10 neutralizing, capacitor useage, radio propegation, AM mod percentage, extra class license study (part 8), 3-400Z linear, ATV vidicon camera, 2 transistor testers, FET compressor, rf plate choke.

OCT 69. Super gain 40M ant, FET chirper, telephone info, scope calibrator, thyrector surge protector, slower tuning rates, identify calibrator harmonics, FM adaptor for AM tx, CB sets on 6M, proportional control xtal oven, xtal filter installation, Q-multiplier, transceiver pwr supply, extra class study (part 9).

NOV 69. NCX-3 on 6M, IF notch filters, dial calibration, HW32A external VFO, 6M converter, feedline info, rf z-bridge, fm mobile hints, umbrella ant, 432-er tx (part 1), pwr supply tricks with diodes, transistor keyer, transistor test design, xtal vhf sign gen, electronic varsac, SB33 mods, extra class study (part 10), SB34 linear improvements.

DEC 69. Transistor-diode checker, dummy load/attenuator, tuned filter chokes, band-switching Swan 250 & TV-2, 88mh selectivity, match exercizes, rtl xtal calibrator, transistor pa design, hv mobile p.s., 1-10 gHz freqmeter, CB rig on 6M, extra license study (part II), 1970 buyer's guide.

JAN 70. Transceiver accessory unit, bench power supply, SSTV color method, bass-tuned center-loaded ant, 6M bandpass filter, extra license study (part 12, rectifier diode useage, facsimile info.

FEB 70. 18-inch 15M dipole, 6M converter, high-density pc board, camper-mobile hints, 2M freq synthesizer, encoding/decoding for repeaters, DX-35 mods, panoramic vhf rx, variable-Z HF mobile mount, extra license study (part 13), linear IC info, qrp 40M tx, IC Q-multiplier.

MAR 70. Gdo applications, charger for drycells, FM freq meter, pc board construction, ham fm standards, cheap rf wattmeter, multifreq fm osc, "IF" system modules (part 1), Six-er mods, gdo dip lite, Motorla 41V conversion, cw monitor, buying surplus logic, SSQ-23A sonobuoy conversion, GRC-9 rx/tx conversion, extra class study (part 14), intro to vhf fm.

APR 70. Noise blanker, 2M hotcarrier diode converter, repeater controller, understanding COR repeater, 7/8-wave 2M ant, extra class study (part 15), inexpensive semiconductors, remounting surplus meters, linear amp bias regulator, hi performance if amp & agc system, SSB bfo for shortwave radio, vacuum tube load box, general fm dope & repeater guide, mugger ing your ant.

MAY 70. Comments on "fm docket" #18803, future of cw, fm-am rx aligner, 5/8 wave verticals, using 2M intelligently, auto burglar alarms, pwr supplies from surplus components, "IF" system modules (part 2), vhf FET preamps, educated "idiot" lites, postage-stamp 6M tx, extra class study (part 16), Bishop IFNL, low-band police monitor, mobile cw tx, Wichita auto patch.

JUNE 70. DDRR ant, vfo circuit, remote SWR indicator, indoor hf vertical, two rx on one antenna, environment & coax loss, 2 el trap verticals, buying surplus, two 40M qrp tx, 21dB 2M beam, extra class study (part 17).

DEC 70. Solid-state vhf exciter, delta fre control for SSB, 2M transistor FM tx, HW100 offset tuning, "little gate" dipper, 3-500Z hf linear, general class study (part 5), "transi-test" (no good – errors!), transistor p.s. current limiter.

JAN 71. Split fones for dxing, Heath Ten-er mods, cw duty cycle, repeater zero-beater, HEP IC projects, 10-15-20M parabolic ideas, lightning protection, IC rx accessory, attic ants, double-balanced mixers, permanent marker tool, ham license study questions.

FEB 71. Metal locator, varactor theory, AFSK unit, SSTV patch box, ATV hints, RTTY tuning indicator, tone encoder/decoder, 220 MHz converter, SSTV magnetic deflection, IC code osc, 6M tx beeper, general class study (part 6), RTTY intro, perf-board terminal, low-ohmmeter.

MAR 71. IC audio filter, IC 6M converter, trap vertical ideas, digi counter info, surplus equipment identification, hf linear, simple fone patch, repeater audio mixer, digi RTTY accessories, coathanger gndplane, general class study (part 7).

APR 71. Intro to fm, noise blanker, repeater problems, Motorola HT mods, microwave repeater linking, digital ID unit, tuneable 2M fm rx/tx, repeater directory, fm marketplace, meter evaluator, varactor modulator, simple sig gen, touchtone hookup, hf preselector, 10M 12W tx.

MAY 71. 75M mobile whip, 2M preamp, transistor amp design, 10M dsb tx, portable fm transceiver directory, audio compressor-clipper, transistor LM freqmeter, 450 MHz link tx, simple af filter, 1-tube 2M transceiver, surplus 2M power amp, general class study (part 8).

JUNE 71. 2M beam experiments, 3 el 2M quad, multi-band dipole patterns, weather balloon vertical, pocket-pager squelch, two-er vfo, tuning mobile whips, transistor pwr supply, capacity decade box, 40M gain ant, general class study (part 9).

JULY 71. IC audio processor, audio sig gen, cw filter, 2M fm osc, 2M collinear vertical, FM supplier directory, Motorola G-strip conversion, transistor beta tester, general class study (part 10).

AUG 71. Ham facsimile (part 1), 500 Watt linear, dimensions for July collinear, 4-tube 80/40 station, vfo digi readout, Jupiter on 15M, general class study (part 11), pink ticket wavemeter.

SEPT 71. Transformerless power supplies, solid state tv camera, IC substitution, two rf wattmeters, IC compressor-agc, multichannel HT-200, ham facsimile (part 2), causes of manmade noise, vfo with tracking mixer, general class study (part 12), transistor heat-sinking, IC pulse gen, fone-patch isolation, hcd wattmeters.

OCT 71. Emergency repeater car, transceiver power supply, predicting meteor showers, digi switching, reverse-current battery charger, passive repeaters, earth grounds, audio "tailoring" filters, Swan 350 mods.

NOV 71. 3-el 75M beam, motor-tuned gnd-plane, 2M gain vertical, transistor biasing, split-site repeater, fox-hunting, audio filter, transistor/diode tester, xtal tester, 6M kw amp, 10-15-20M quad, transistor pi-net final, ant feedline, communications dbs, 2300 MHz exciter.

AUG 72. SSTV intro, speech processor, fm repeater info, test probe construction, GE progline ac supply, 432 rf testing, preamp-compressor, Six-er mods, fone patch, Two-er info, solar info, SCR regulator for HVPS, "ideal" xtal osc, fm rx adaptor, auto theft alarm.

SEPT 72. Plumbicon tv camera, WWVB 60 kHz rx, cigartube sig gen, cw active filter, rf testing at 1296-3500 GHz, balun ant feed, transistor power supply, IC 6M rx, IC fm/gen detector (part 2), active filter design (part 3), K2OAW freq counter (part 3), 2M freq synthesizer (part 1).

OCT 72. Corrections for Aug. fm rx adaptor, 2M freq synthesizer (part 2), 6M transistor vfo, nano-ampere meter, time-freq measurement (part 1), active filter design (part 4), repeater timer, extra-class Q&A (part 3), balloon vertical, ID gen, time delay relay, 432 filter ideas, DC-AC inverter, hc-diode converter, rtl decade and nixie driver, plus-minus supply for ICs.

NOV 72. Hf transistor power amps, RTTY selcal, IC trf rx, transistor keyer, emergency power, 220 MHz preamp, double-delta ant, simple converter using modules, hf RF tester, "lumped line" osc, 2M freq synthesizer (part 3), K2OAW counter errata, 2M preamp, extra class Q&A (part 4), hi-Z voltmeter, Nikola Tesla story, vhf swr meter, transistor regen rx, 432 SSB transverter, AC arc welder, intro to computers, hybrid am modulator, HR10 rx mods, 10M transistor ant tx, 40M gndplane, IC logic demonstrator, overload protection, if/rf sweep generator, digi freq counter, aural tx tuning.

DEC 72. SSTV scope analyzer, 2M fm rx, tone burst encoder and decoder, universal if amp, autopatch hookup, LM380N info, voltage variable cap info, 2M 18 watt amp, SSB modulation monitor, xtal freq/activity meter, 10A var. dc supply, transmission line uses, radio astronomy, inductance meter, 75 to 20M transverter, LED info, 40M preamp, transistor vfo, 1972 index, 2M preamp.

JAN 73. HT-220 touchtone, 3-el 20M yagi, 50 MHz freq counter, speech processor, 2-tone gen, fm test set, tilt-over tower, 6M converter using modules, tuneable af filter, six band linear, 10M IF tuner, diode noise limiter, cw/ssb agc, HW22a transceiver 40M mod, HAL ID-1 mod.

FEB 73. CW id gen, tone operated relay, toroidal quadrature ant, active filter, time freq measurement (part 2), repeater timing control, SSTV circuits (part 1), 2M converter using modules, multifunction metering, FET biasing, freq counter preamp, TR22 hi-power mod, transistor rf power amps (part 1), light bulb rf power indicators, 75A4 filters, capacitance measurement, Gonset 201 mod, world time info.

APR 73. FM deviation meter, 2M FET preamp, two 2M power amps, repeater control (part 1), repeater licensing, Europe, 2M fm, fm scanner adaptor, RCA CMU15 mods, lightning detector, cb alignment gadget, transistor rf power amps (part 2), repeater economics.

JUNE 73. 220 MHz sig gen, uhf power meter, repeater licensing info, RTTY autoswitch, 40M hybrid vfo tx, ant polar mount, 10-15-20M quad, K2OAW counter mods, double coax ant, ham summer job, tone decoder, field strength meter, nicad battery pack, ohm meter, FCC regs (part 1).

AUG 73. Log-periodics (part 1), tone burst gen, rf power amp design, transistor radio intercom, 160M ant, SSTV monitor, low cost freq counter, VOM design, qrp 40M tx, 432 MHz exciter, fm audio processing, FCC regs (part 3).

SEPT 73. Repeater control system, log-periodics (part 2), 2M rx calibrator, PLL ic applications, TT pad hookup, Heath HW7 "s" meter, Oscar-8 doppler, 2M coaxial ant, 2M converter, IC keyer, measure ant Z, FCC regs (part 4).

OCT 73. GE Pocketmate mods, microwave freq measurement, CA3102E 2M frontend, 2 kw hf linear, rf wattmeter, meter repair, 60/40 dipole, IC "hi" gen, vhf freq multiplier, FCC regs (part 5).

NOV 73. 450 MHz exciter, intro to ATV circuits, nicad voltage monitor, autopatch connections, IC meter amplifier, TR22 ac supply, indoor vertical, IC af filter, momentary power failure protection, 160M ant acoupler, Motorola HT info, SSTV-ISB, Class-B rf amp, FCC regs (part 6).

DEC 73. Code speed display, 2M kw amp, IC keyer, 8038 waveform gen, helical resonator design, sensitive rf voltmeter, proximity control switch, IC tester, sequential tone decoder, 2M portable beam, atomic calculator math, cw filter design, FCC regs (part 7).

FEB 74. SSTV monitor info, IC audio amps, scope sweep gen, 15/20M vertical, telephone line control system, pc board construction, var-Q af filter, blown-fuse indicator, 40m cw stn with Ten-Tec modules, simple preamp-compressor, single-IC rx, "432-er" final assembly, transistor keying circuit, 7-segment readout with nixie driver.

APR 74. Vox for repeaters, tone-operated relay, hf transverter, 10-to-2m tx converter, remote control panel for scanner, RCA fm tx tuning, subaudible tone gen, FCC regs (part 9), Repeater Atlas.

MAY 74. Cd car ignition, audio compressor info, interference suppression for boats, auto burglar alarms, 2m ic preamp, 10m fet converter.

JULY 74. 4-1000A linear, universal freq gen, universal afsk gen, 555 IC timer, 80M phased array, 135 kHz-432 MHz preamps, 10M qrp am tx, 3000 vdc supply, how to read diagrams.

AUG 74. Toroidal directional wattmeters, 450 MHz FET preamp, use gdo to find "c", Trimline tt pad hookup, R390 & R392 rx mods, tracking cw filter, aural voltmeter, universal regulated supply, sstv scan converter, ttl logic problems, ID timer.

SEPT 74. MOSKEY electronic keyer (part 1), ex warning system, Heath 10-103 scope mods, qrp 6M am tx, rf speech clipper, audio noise limiter, wx satellite on SSTV monitor, universal IC tester, miniature rig construction, tower construction, infinite rf attenuator, electronic

(More)

photo-flash ideas, IC "select-o-ject."

OCT 74. Microtransistor circuits, synthesized HT 220 (part 1), repeater government, regulated 5 vdc supply, 1m selcal, removeable mobile ants, Motorola metering, 2M vertical collinear, Motorola model code, 2M coaxial dipole, 1.6 MHz if strip, MOSKEY electronic keyer (part 2), carbon mike circuit, hi power hi pass filter, 6M preamp, 3-wire dipole, ATV sync gen, NCX 5 mods, mobile whip for apartment dwellers, sstv auto vertical trig.

NOV 74. K2OAW counter update, regulated 5 vdc supply, wind direction indicator, synthesized HT-220 (part 2), 20M 3-el beam, autopatch pad hookups, double-stub ant match, novice class instruction, digi swr meter (part 1), 6M converter (1.6 MHz if), "C-bridge," MOSKEY electronic keyer (part 3), Aug. sstv scan converter errata, repeater off-freq indicator.

DEC 74. Care of nicads, wind speed/direction indicator, wx satellite video converter, electronic keyer, hints for novices, unknown meter scales, SSTV tape ideas, TTL logic probe, public service band converter, tuned-diode test receivers, digi swr meter (part 2), telephone pole beam support, rhombic antennas, 1974 Index.

FEB 75. Heath HO-10 scope mod for SSTV, electronic keyer, digital satellite orbital timer, Oscar 7 operation, satellite orbital prediction, Heath SB-102 mods, comparing FM & AM, repeater engineering, Robot 80-A sstv camera mod, neutralizing Heath SB-110A, "Bounceless" IC switch, tape keyer for cw tx.

APR 75. $50 walky for 2M, 2M scanning synthesizer, 88 mH toroid info, 8-function repeater controller, nicad battery precautions, TR22C preamp, telephone attachment regs, Guide to 2M Hand-held Transceivers, 2M 7-el beam, basic telephone systems (part 1), 10 min ID timer, modified hf Hustler mobile ant for 2M, 15M quad modified for 20M, 2M collinear beam, R-11A surplus rx conversion, 5/16-wave 2M ant, Hallicrafters SX-111 rx mods, 160M cw tx.

AUG 75. 146/432 MHz Helical ants (part 2), 10 min ID timer, digi swr computer (part 1), debugging rf feedback, DVM byer's guide, wx satellite monitor, cmos "accu-keyer," pc board method, sweep-tube final precautions, compact multiband dipoles, small digital clock, accessory vfo for hf transceiver, modern non-Morse codes, multi-function gen, 2M scanning synthesizer errata, KP-202 walky charger, 10M multi-element beam.

SEPT 75. Calculating freq counter, wx satellite FAX system (part 1), IC millivoltmeter, three button TT decoder, troubleshooting sstv gen, 40M dx ants, 146/432 MHz helical ants (conclusion), digi swr computer (conclusion), reed relay for cw bk in, NE555 preset timer, power-failure alarm, portable qrp rig power unit, precision 10 vdc reference standard, 135 kHz if strip, telephone handsets with fm transceivers, Motorola T-44 tx mod for ATV, 0-60 MHz synthesizer (part 10, ham radio PR).

Since there's little to get stale in back issues of 73 (our magazine is not padded ... like others ... with reams of activity reports), you'll have a fantastic time reading them. Most of the articles are still exciting to read ... and old editorials are even more fun for most of the dire predictions by Green have now come to pass. Incentive licensing was every bit the debacle he predicted ... and more. You'll really get a kick out of the back issues.

OCT 75. A deluxe TTY keyboard (part 1), Op Amps: a basic primer, an introduction to microprocessors, 2m Synthesizer (conclusion), Satellite Fax System (conclusion), regulated supplies (dispelling the mystery), Digital Logic made simple, FCC interview, a contest uP system, digital clock time bases, the operating desk, QRP 432, ham PR.

NOV-DEC 75. Blockbuster double issue! Flip-flops exposed, breakthrough in fast scan ATV, strobing displays is cool, the tuned lunch box (antenna tuner for HF transceivers), a deluxe TTY keyboard (part 2), the 127' rotating mast, less than $100 multi-purpose scope for your shack (part 1), predicting third order intermod, feedline primer, QRMing the Third Reich, why tubes haven't died, instant circuits – build your own IC test rig, the K2OAW synthesizer PROM-oted, a ham's intro to microprocessing, Ground Fault Interrupter (a keep alive circuit for yourself), a $1 strip chart recorder, an even simpler clock osc., the Fun City surplus scene, updating the Heath IB-1101 counter, 256 pages!

JAN 76. Clocks – Really Simplified, De-Bugin your Ham—Hi, An Automatic Dialer for the Deluxe Mobile, Zapping Dead Nicads to Life, The Computer CBO Machine, $50 Self-Powered Counter, Save Money on Coax, How to Pass Exams, Using a Bargain Surplus Keyboard, Improve Your SSTV with the FRAMER, and more. The first 73 in new large format! (Includes 1975 Index to 73).

FEB 76. Build a StarFleet Communicator – Trekkies Special, Synthesized IC Frequency Standard, You Can Make Photo PC Boards, How's Your Speech Quality?, ASCII to Baudot Converter, RTTY Autopatch – the Digital Way, Improving the FT-101, Night DXing on 10 and 15m, Really Soup Up Your 2m Receiver, Put Your SB-10 on 160m.

MAR 76. Special Surplus Issue – Tunable FM Receiver Strips, Surplus Circuit Boards – A Gold Mine of Parts, Space Age Junque, A PC Board Bonanza, Government Surplus: Is It All Gone?, Stereo – A New Type of CW Filter, Build This Exciting New TVT, The Smart Power Supply, How to Use Surplus Pots.

APR 76. Special FM Issue – A Programmable ID, Put That AM Rig on FM, A COR for your Receiver, A $5 100 Watt Amplifier, Build a 220 MHz Repeater, Carrier Indicator for Your Regency, Long Distance Call Eliminator, Simple New TT Decoder, One IC Tone Burster, The Tuna-Tess Tripler, A Versatile TTY Generator, The PLL – Exposed!, TR-22 Tips, Computers Are Ridiculously Simple.

MAY 76. Special Antenna Issue – The Magnificent Beams Microbeta, An Altband Inverted Vee, Closed Loop Antenna Tuning, The 75-80m Broadbander, The Magic of a Matchmaker, How to Coax Your Antenna, 40m DXing – Clay Style, The Secret 2m Mobile Antenna, An Inverted Vee for 160-80m, The Dipole Dangler, Amateur Weather Satellite Reception, Soup Your HR212, A Very Cheap I/O – the MOdel 15, Code Converter Using PROMs, A Kirby Cassette-Computer System, The Ins and Outs of TTL, Build a CW Memory, 5/8 Wave Power for Your HT, $55 Timer Sweep Circuit for SSTV, AM is Not Dead – It Never Existed at All, Computer Languages – Simplified.

JUN 76. VHF Special – Super COR – Digest of Course!, Touchtone Decoder – Using a Calculator Readout, Simple Amateur TV Transmitter, Amateur TV Receiving System, Mobile Autodialer, Autopatch '76 – Using a Touchtone Decoder, Build This Lab Type Bridge – and Measure Transformer Impedances, How Those Triangle Things Work – a Sort of Op Amp Handbook, Those Exciting Memory Chips – RAMs, ROMs, PROMs, etc., ASCII/Baudot with a PROM – for Ribbentrop RTTY on Computers, Arm Your Beam Right – With a Programmable Calculator.

JUL 76. Perfect CW – Drive 'em Crazy with the Keyzader I, The Mini-Mite Altband QRP Rig – A Mighty 7 Watts, A Fun Counter Project – Under $50, Build a FAX from Scratch – Then Get Satellite Pictures and Other Things, Dar Repeatermeister – Repeater Control with IO, The Giant Nixie Clock, Creative SSTV Programming, CW Regenerator/Processor, What's Up on 198 MHz?, TT Pad for the Wilson HT, Power Supply Testing – To Save Your Digital Circuits, A RTTY/Computer Display Unit, Your Computer Can Talk Morse, Gain for Your HT – a Half Wave Whip, The Super Tapemarch, Simple VHF Monitor.

AUG 76. How Do You Use ICs? – Fundamentals, Surprising Miniature Low Band Antenna – the SDRR (Part II, MINIMAX – the Best Keyer Yet?, The Skeptic's Delight Breadboard – Cheap Imitation of a Commercial IC DIP Board, More PLL Magic, The Logic Grabber – Selected Interval Logic Trace, Global Calculations for the Dollar – Using a Hand Calculator, Instant Counter Calibration – Using Your TV Set, Simple 450 MHz Rig – Go ATV With a $42.50 Module, The First Computer Controlled Ham Station – Grand Prize Winner, The Whole Chip Dilemma! – 4, 8, 12, or 16 bits: pros and cons, Meaningful Conversations with your Computer – What All Those Mysterious Languages Are All About, A Baudot Monitor/Editor System, A Logic Probe You Can Hear, Satellite Orbit Predicting – Using a Pocket Calculator, FSK with the SB-401, Build the Safari RTTY Terminal, El Cheapo Signal Tracer – Test Gear for the Checkbook.

SEP 76. The Surprising DDRR Low Noise Antenna (part III), Ultrasimple Regulation with New IC – Power Supply Design Greatly Simplified, Can an Indoor Antenna Work – Making the Best Out of a Bad Bargain, Inexpensive 12 Volts for Your Base Station, A Test Lab Bonanza – Using a Transistor Radio, Present Your VHF Converter – Novel Antenna Relay, Ridiculously Simple RTTY System, How to Catch a Clker, A 450 MHz Transceiver for Under $130, Space Age Junque II, PROM Memory Revealed, Eight Trace Scope Adapter, The PROM Zapper, Smoky Bauder – With an ASCII Keyboard!, Simple Graphics Terminal – Using surplus, Counters are Not Magic – They're Simple.

OCT 76. Build a Weird 2 Band Mobile Antenna, Build a Counter for Your Receiver, How do You Use ICs? (part III), QRP Fun on 40 and 80 – Have a Real Ball with Just 5 Watts, The Hybrid Quad – Low Windload, Expense, Hassle!, Frequency Detector for Your Counter, Programmable CW ID Unit – for RTTY, Repeaters, Mobile, etc., New ICs for the Counter Collapse – Simpler Counters with Less Used Power, Is My Rig Working or Not? – Build an Effective Radiated Field Meter and Know!, Quickie Coilwinders for 10 and 10 – a Satisfaction Guaranteed, Build a Super Standard – Goes Right Down to 1 Hz, The Incredible Lambda Diode, Mechanical RTTY Buffer, Have You Used a Triac Yet?, How to Interface a Clock Chip – Baudot, BCD, or ASCII Conversion, A TTL Tester – Great for Unmarked Bargain ICs, The New Ham Programmer – Making Those Confounded uPs Work, BASIC? What's That? – the Basics of BASIC, The Soft Art of Programming (part I).

NOV 76. Blockbuster 288 pg issue! Cordless Ham Type, Bicycle Mobile, Build a Simple Lab Scope – Costs Less Than $70!, Get on Six with Surplus – The El Cheapo RT-70 is a Natural, The Beam Saver – Razor Memory System, Updated Universal Frequency Generator, The Short Pocket Touchtone, Liquid Crystal Display Guide, Self-Powered Mike Preamp, The Wind Counter, The 538 is Not Dead!, The Amazing Inverted L – Antenna for 20, 40, and 80m, Battery Chargers Exposed, How Do You Use ICs (part III), Thirty Years of Ham RTTY, Big Hoots Burglar Alarm, Dandy Digital Dial Decoder, Weather Satellite Display Control, Ham Time-Sharing is Here for You!, The Soft Art of Programming (part II), OSCAR Orbits on Your Altair, ASCII/Baudot Converter for Your TVT, The Smoke Tester – Power Supply Tester, The Man Who Invented AC – Tesla, the Greatest Pioneer of Them All!, Baudot to ASCII – You Want to Learn Programming?, Baudot and BASIC – an Interpreter for a Baudot Computer, Toward a More Perfect Touchtone Decoder, Using a Wireless Broadcaster, The Quiet Spy – Amateur Unsavers Spy Ring in the UBI, The Beauties of Subsonic Monitoring – And How to Do It.

DEC 76. Go Tone for Ten – Simple Subaudible Encoder, World's Simplest Few Band Receiver?, How Do You Use ICs? (part IV), A Super Cheapo CW ID'er, The 29' Special Antenna, CT1881 Clock-buster, Saving a CBer, A Ham's Computer, What's All This LSI Bunk? – an Ostrich's Eye View of the Microprocessor, The Soft Art of Programming (part III), Put Soup into Your SSTV Pictures, Using a $30 Frequency Standard, What's all This Wire-Wrap Stuff? – Talk About Cold Solder Joints!, Exploding the Power Myth, Exploding the SWR Myth, The IC-22 Walkie – Portabilization with Nicads, Watch DX with a Spectrum Analyzer, DXing with a Weather Map.

HOLIDAY 76. 50 article issue! An Inexpensive 600 Watt HF amplifier, How Do You Use ICs? (part V), Mobile Smashing Detector – 10.5 GHz Use It or Lose It!, Add RIT to Your Transceiver, DXpedition: Memories for a Lifetime – Reflections of HK1TL, Design Your Own QRP Dummy Load, Foilsafe Super Charger – Multi-use tool, The Amazing 16" Antenna for 160m, Replacing the Knife Switch – Simple TR System for the Novice, How You Can Synthesize – the VHF Engineering Approach to 2m Hamania, Hutchinson's Remedy – the Dorpdon CW Machine, The Mad Squad Does the Pocket Scanner – Radio Shack Pro-4 Update, TR-22 Mod Squad, What Computers Can and Can't Do, A Ham Shack File Handler – Program in BASIC for OSLs, Repeaters, etc., Print Your Own Logbook – On Your Nearest Computer, Shaving Your HT, Cash In on the CB – Installation for Fun and Profit, Turning Those Big Antenna Coils, The 2m Mod Squad Tackles the Weather Radio – and Wind, Hamming by Laser, A 88 Foot Antenna on a 30 Foot Lot – Solving a 40m Rotator problem, Dual Voltage Power Supply, An Autopatch Busy Signal, Inside the GLB – a Gutsy Look at a Synthesizer, How to Bug an Automatic Keyer, A 450 Duplexer – That Fits on Your Car, Will Silver-Zinc Replace the Nicad?

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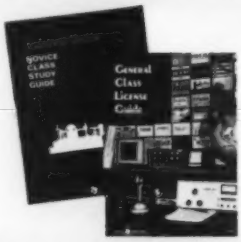

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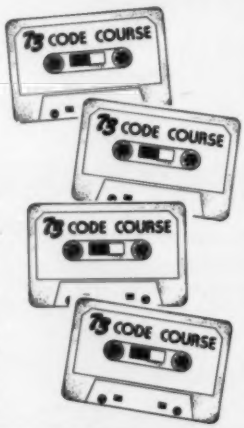

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13 WPM Code groups again, at a brisk 13 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back-breaking tape.

20 WPM Code is what gets you when you go for the Extra Class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape. No one who can copy these tapes can possibly fail the FCC test. Remove all fear of the code forever with these tapes.

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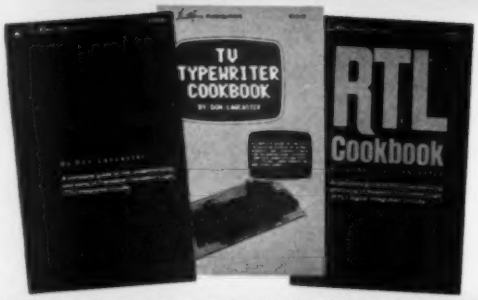

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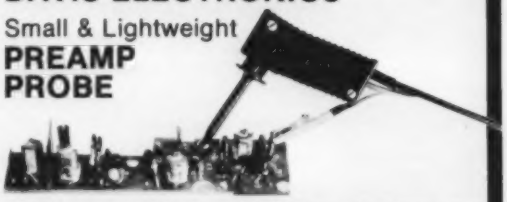

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